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Demsky

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(54) **BACKPACKS CONFIGURED TO UTILIZE SAFETY HARNESSES**

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(21) Appl. No.: **12/202,866**

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Related U.S. Application Data

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(51) **Int. Cl.**
A45F 3/04 (2006.01)

(52) **U.S. Cl.**
USPC **224/576**; 224/637; 224/628

(58) **Field of Classification Search**
USPC 224/637, 628, 630, 631, 633, 635, 224/638, 641, 262, 662, 663, 675, 625, 576; 2/76, 237
See application file for complete search history.

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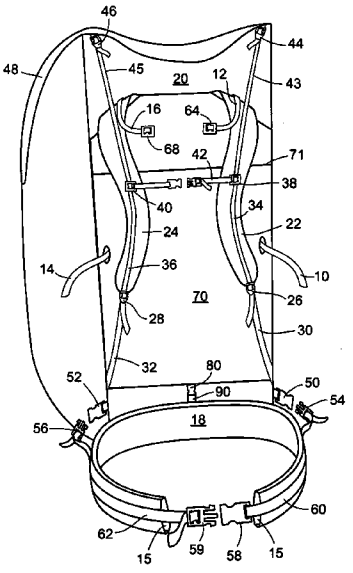
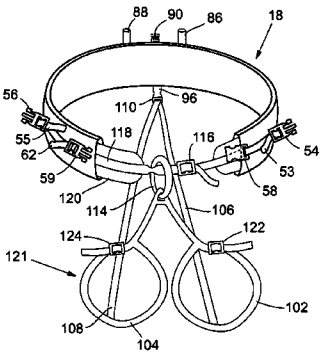
Primary Examiner — Justin Larson
(74) *Attorney, Agent, or Firm* — Baumgartner Patent Law; Marc Baumgartner

(57) **ABSTRACT**

Novel backpacks, configured to utilize seat and/or chest harnesses are disclosed herein. Preferred backpacks are configured to attach to and be supported by intermediary connectors including hip belts or backpack supports that can operably couple to separate seat harnesses.

22 Claims, 13 Drawing Sheets





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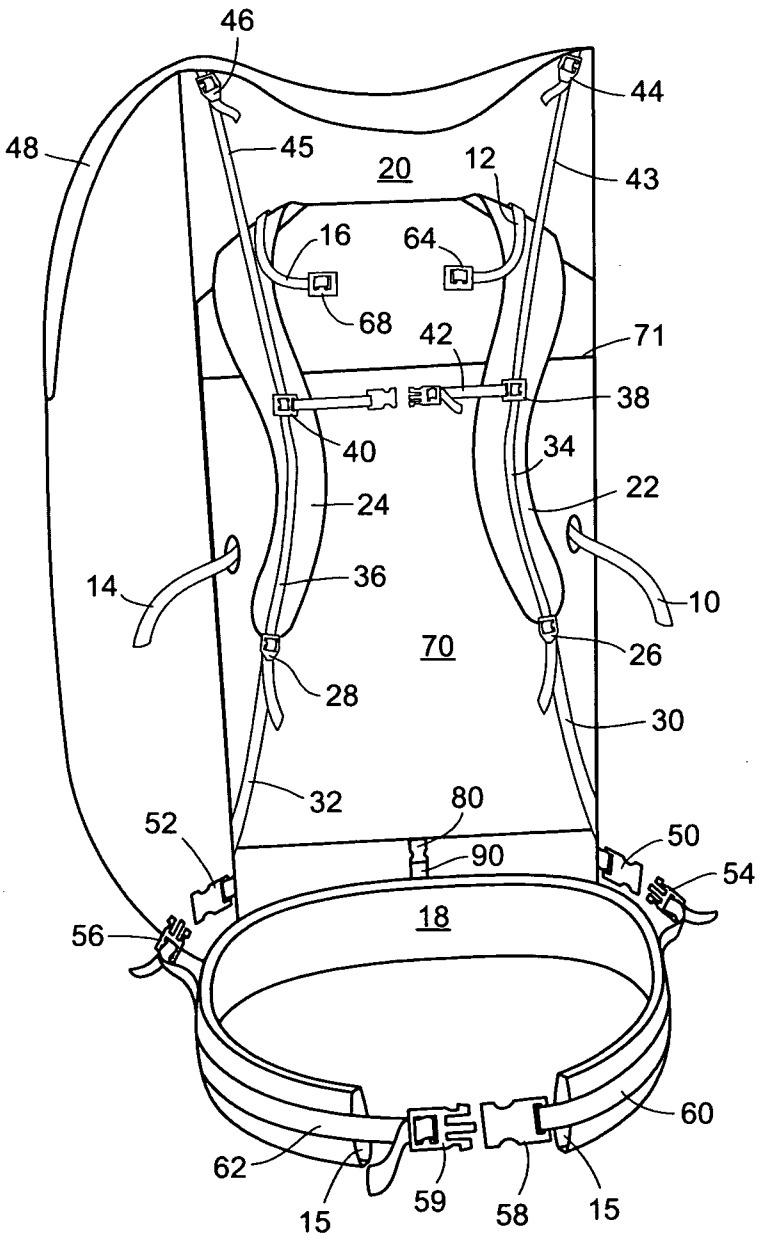
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Fig. 1

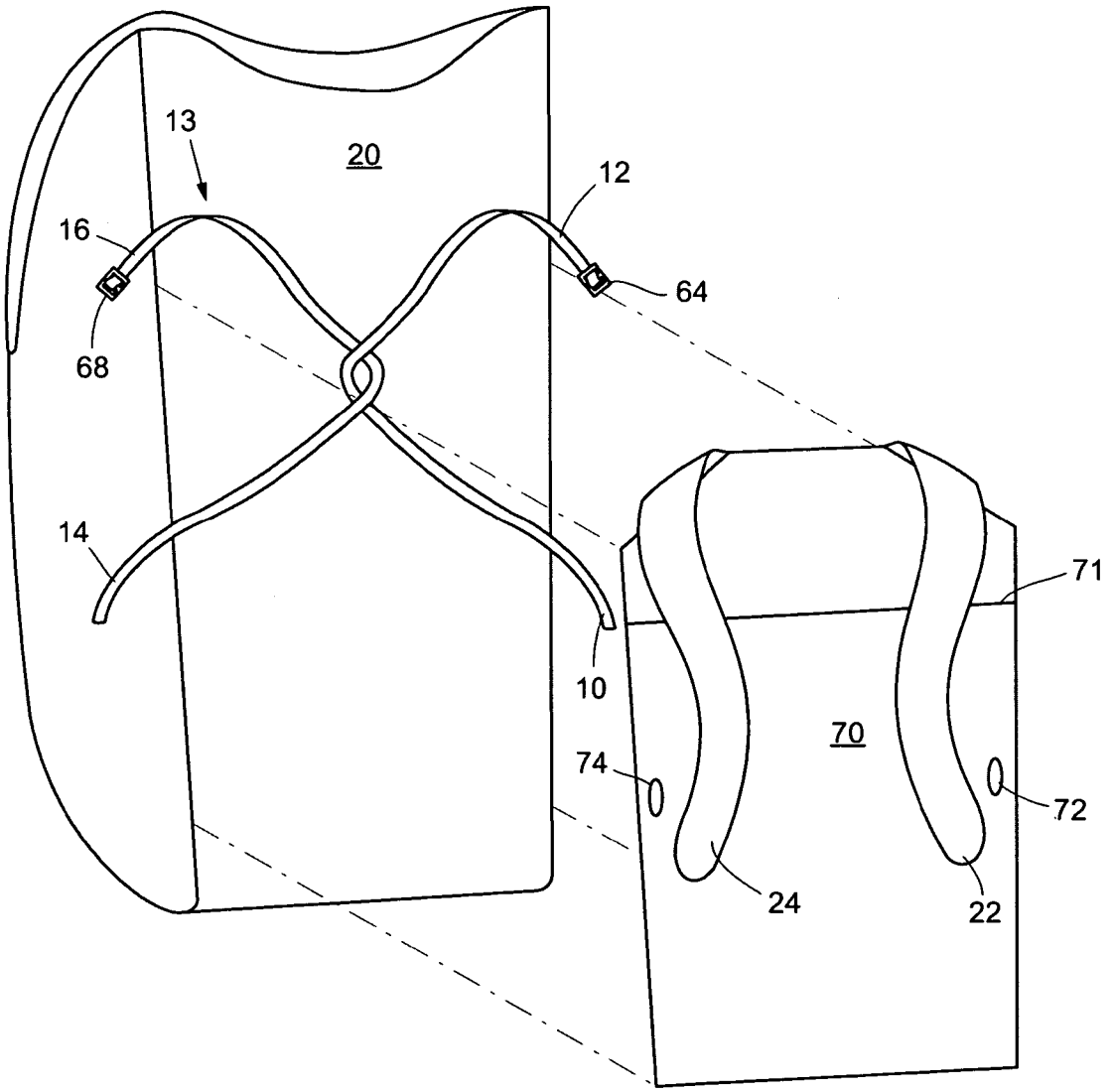

Fig. 2

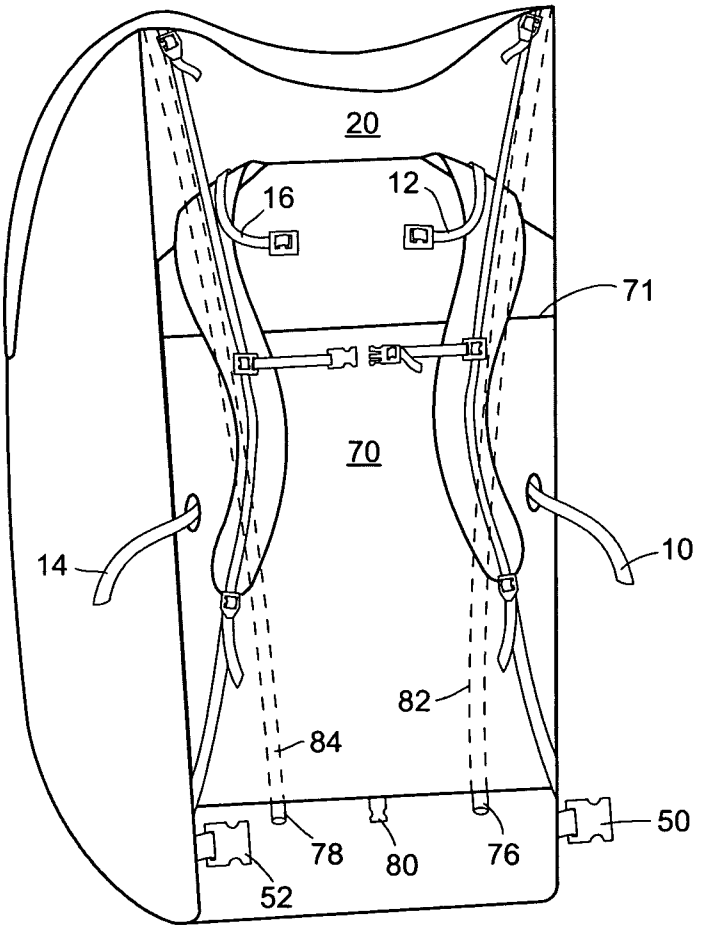

Fig. 3

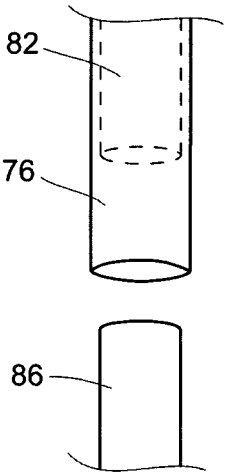

Fig. 4a

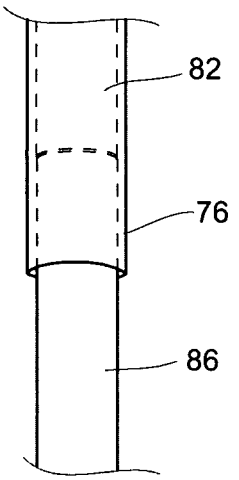

Fig. 4b

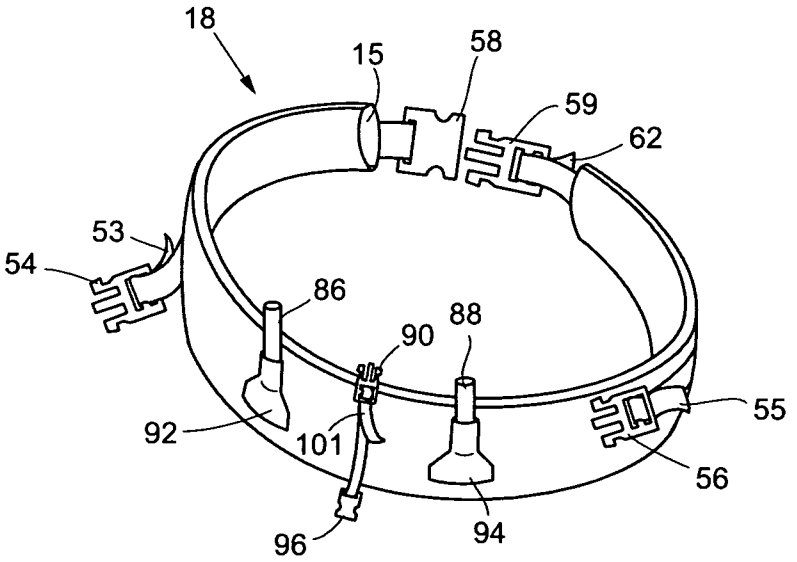

Fig. 5a

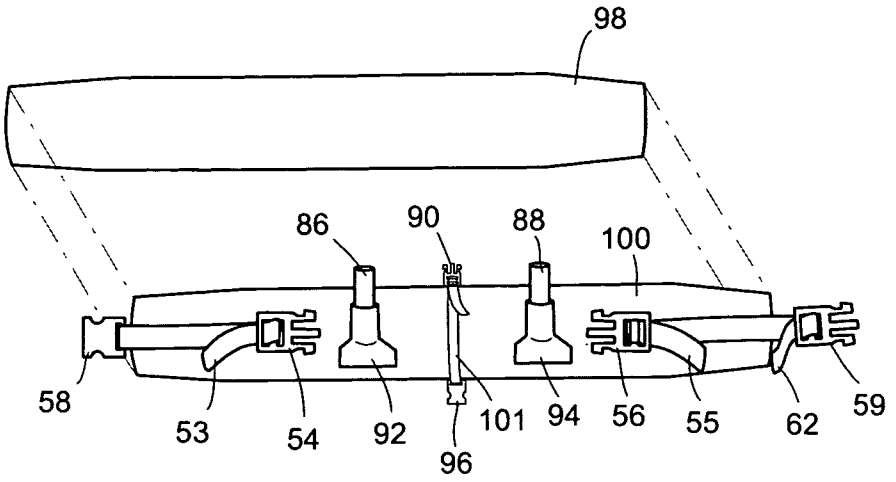
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Fig. 5b

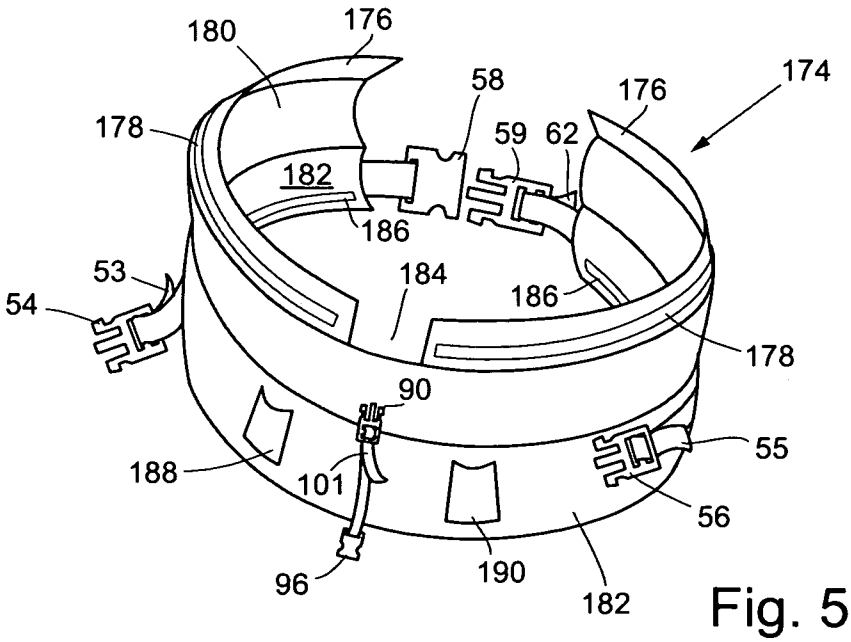
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Fig. 5c

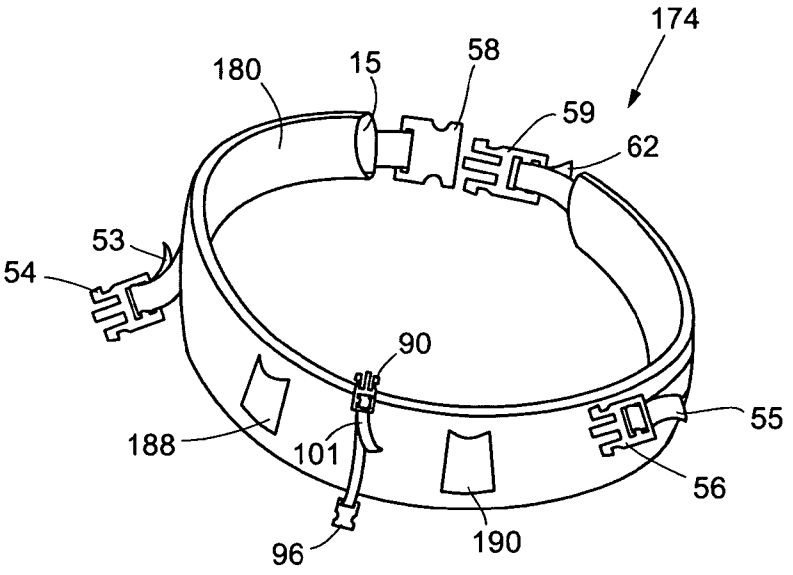
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Fig. 5d

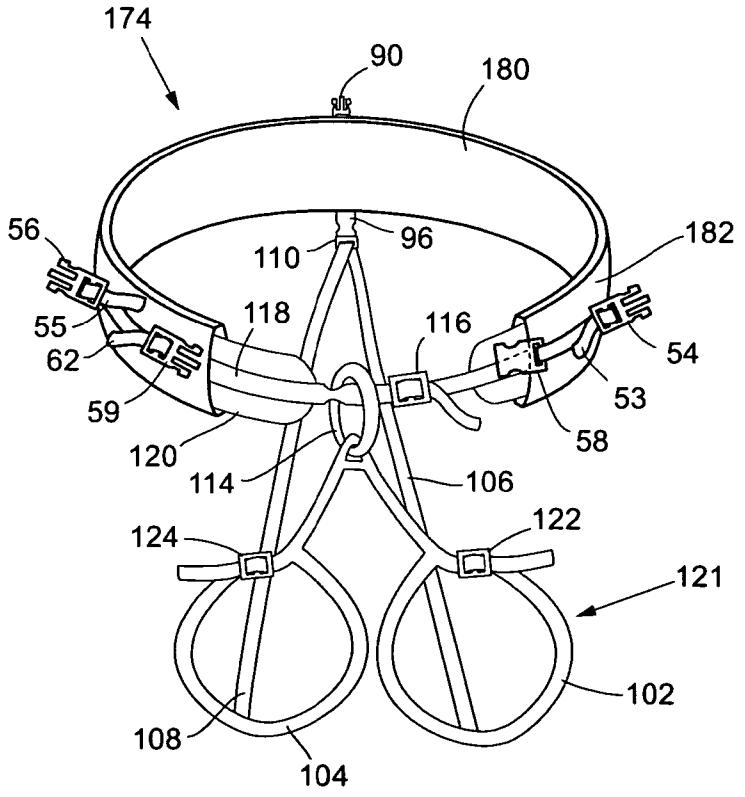
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Fig. 5e

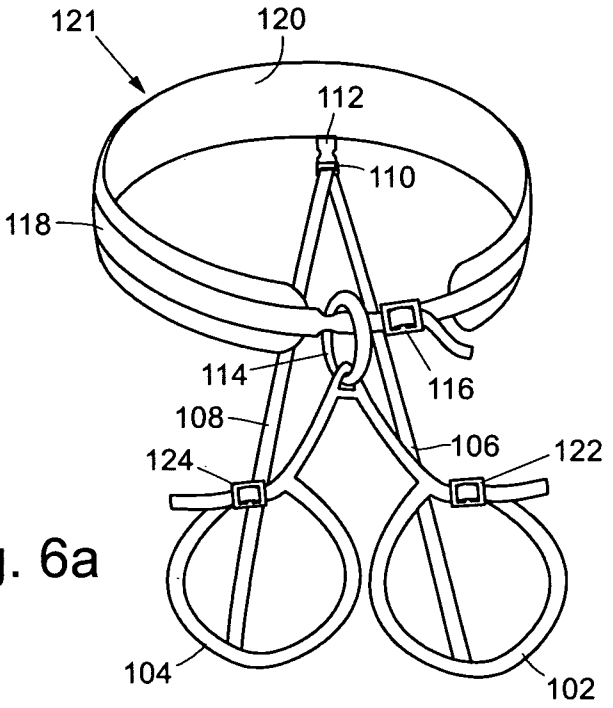
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Fig. 6a

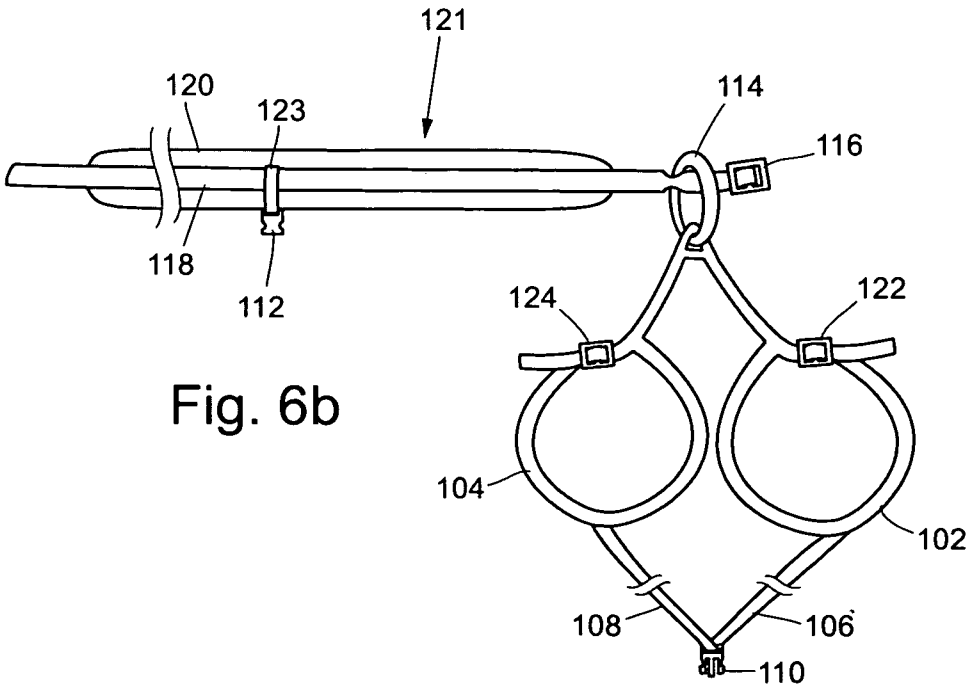
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Fig. 6b

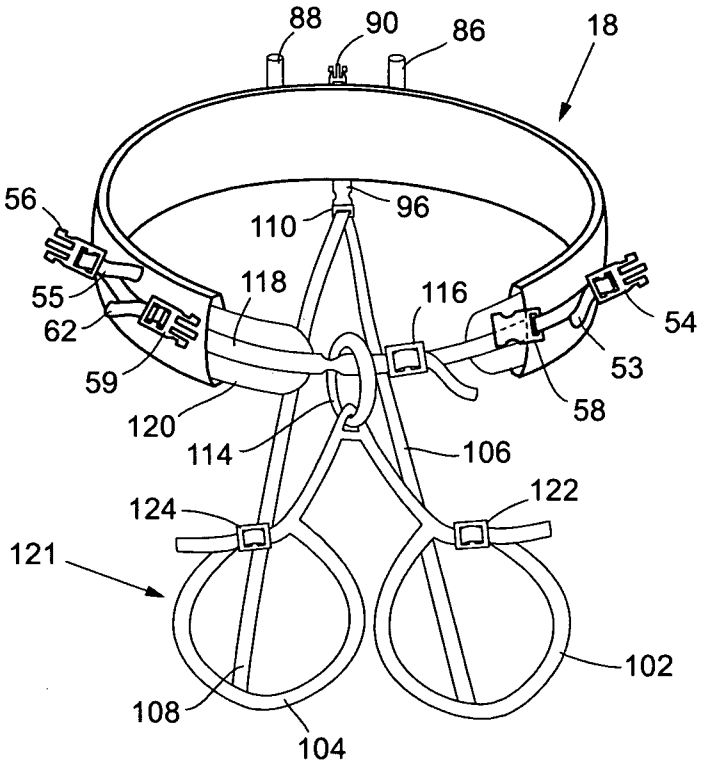
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Fig. 7

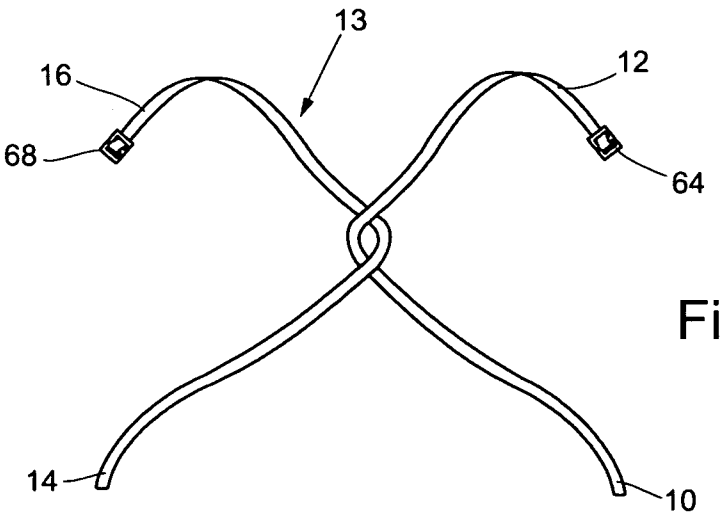
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Fig. 8

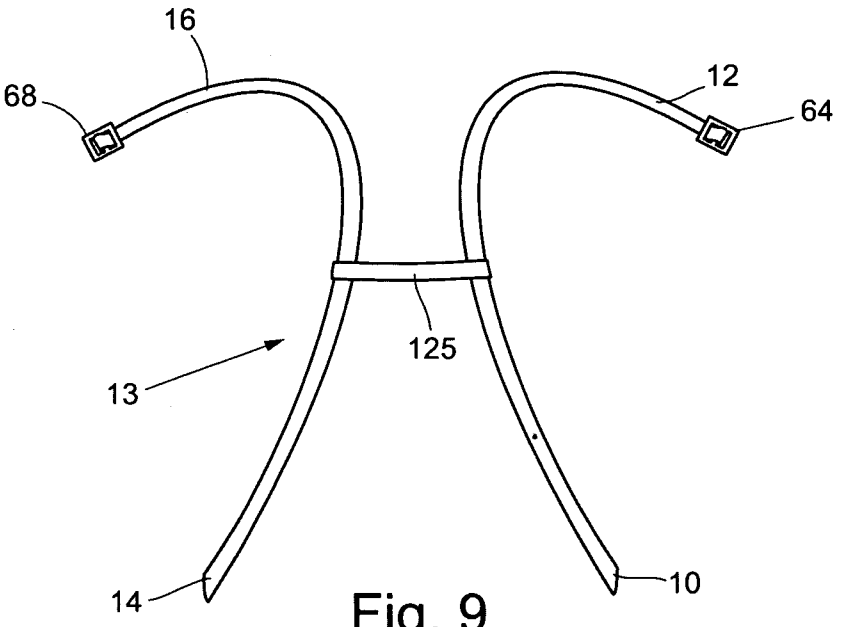


Fig. 9

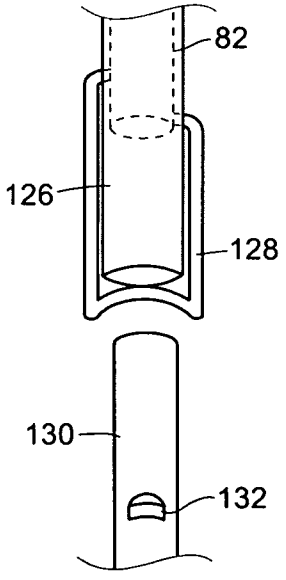
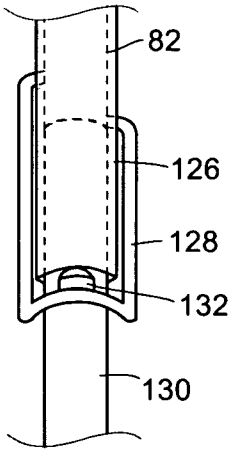


Fig. 10a



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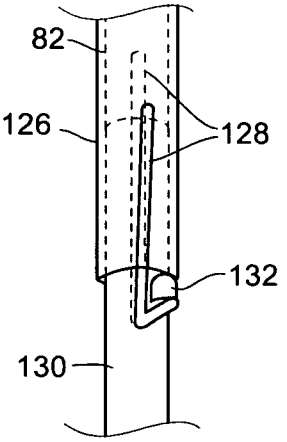


Fig. 10c

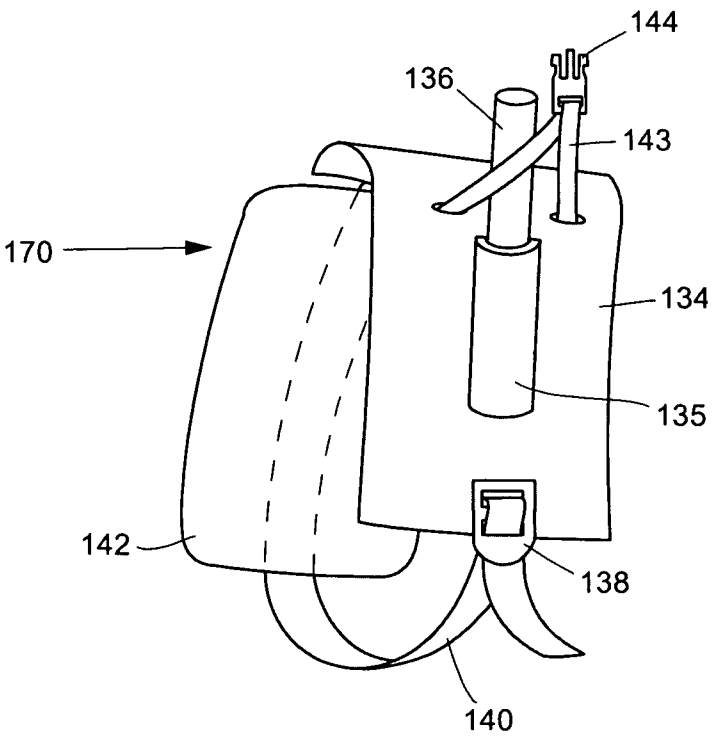


Fig. 11a

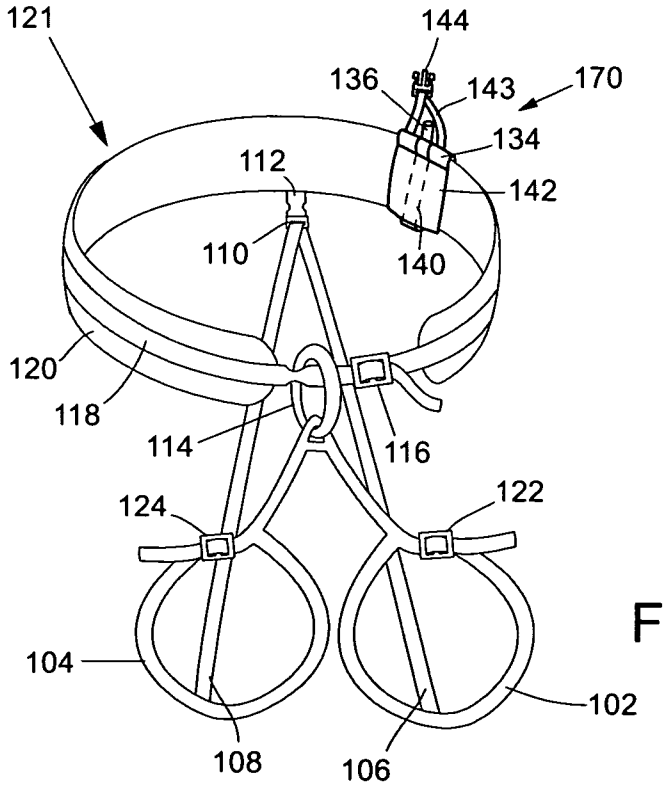
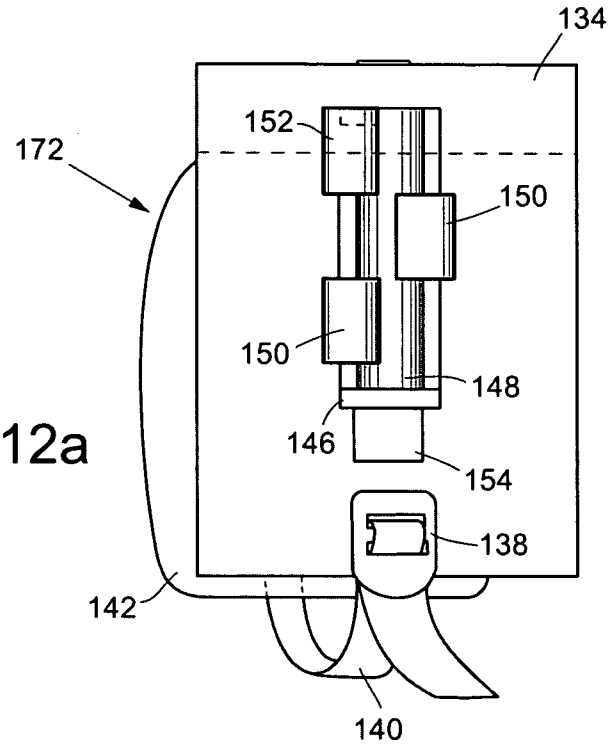


Fig. 11b



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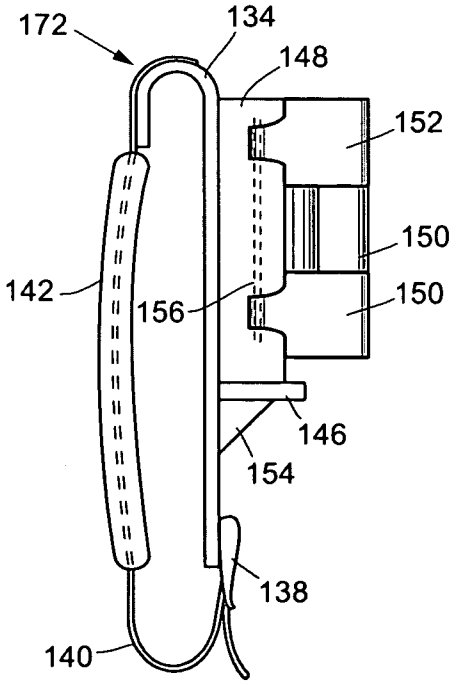
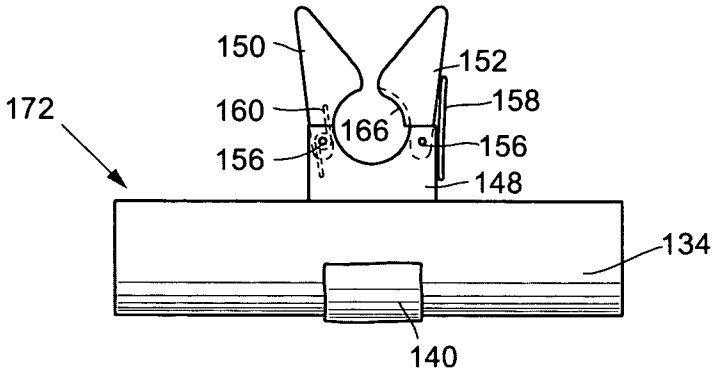


Fig. 12b



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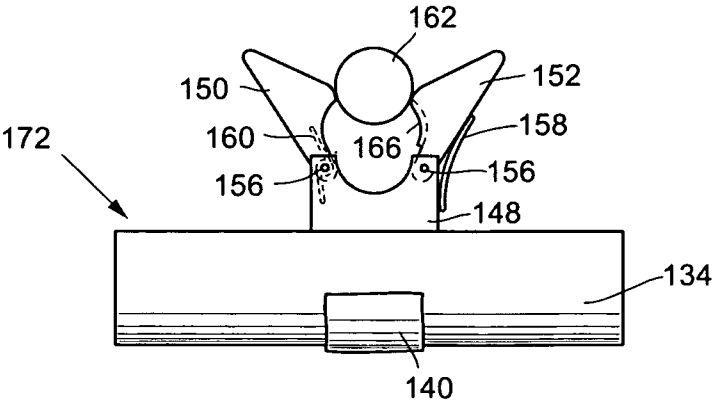

Fig. 12d

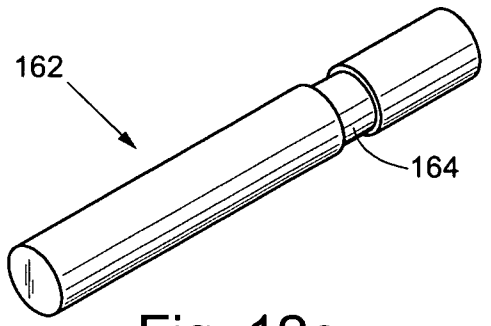

Fig. 12e

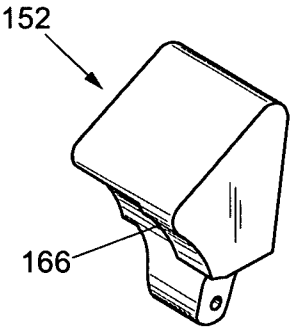

Fig. 12f

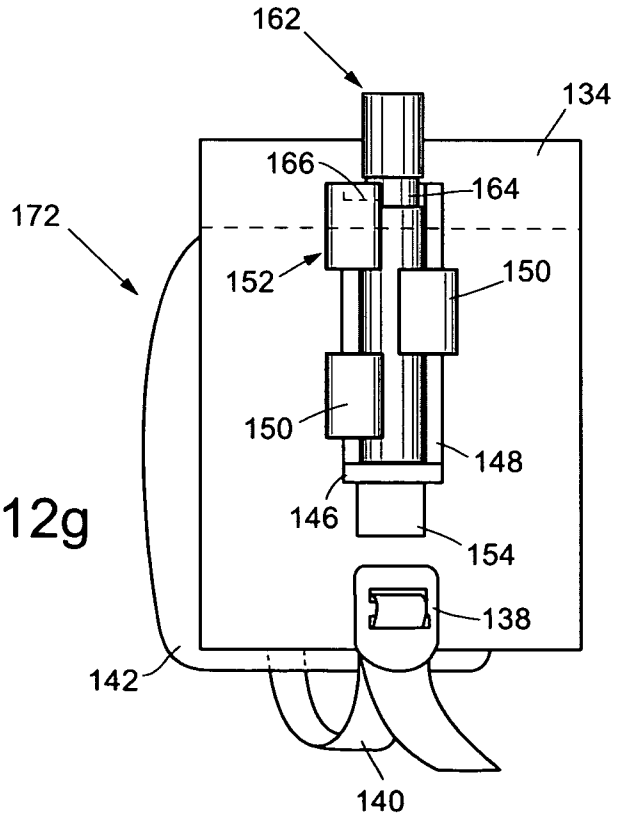

Fig. 12g

BACKPACKS CONFIGURED TO UTILIZE SAFETY HARNESSES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application Ser. No. 60/969,635, filed Sep. 2, 2007 and U.S. Provisional Application Ser. No. 60/969,739, filed Sep. 4, 2007, both of which are expressly incorporated by reference in their entireties.

FIELD OF THE INVENTION

The embodiments herein relate to backpacks configured to allow users to simultaneously carry a significant load while utilizing one or more safety harnesses. This invention generally relates to any field which is aided by carrying materials via a backpack and can benefit from the added safety of a seat harness and/or a chest harness. Fields that fall into but not limited by this category are: mountaineering, rock climbing, and canyoneering, though this invention may have other uses such as military applications, and search and rescue efforts, for example.

BACKGROUND

Backpacks have evolved considerably and can efficiently and comfortably carry a wide range of weight. The modern backpack may or may not include a rigid frame, the former having the added advantages of the ability to transfer the load to the wearer more efficiently and to carry a substantial load; the latter having the added advantage of the backpack adding a minimum amount of weight to the wearer's overall carried weight. Modern backpack designs transfer weight to the wearer's skeletal frame, specifically to the hipbones and the shoulders, where the shoulders play a secondary role in maintaining maneuverability and balance to the material load carried by the backpack.

Generally a safety harness is an independent item used by a wearer to protect against falling and to provide partial or full support when used with an attached safety line(s). Under certain configurations, safety harnesses also allow the user to conserve energy, as the harnesses can support them against gravitational force during ascents and descents.

In general, there are 3 categories of safety harnesses currently available: 1) a full body harness which distributes a resulting load to the wearer's body including legs, waist, and upper body; 2) a seat harness which applies a resulting load to the wearer's legs and waist; 3) and a chest harness which applies a resulting load to the wearer's chest and shoulders. A seat harness is almost the exclusive form of safety harness for mountaineering, rock climbing, and canyoneering due to the restrictive nature of a full body harness to movement and the chest harness's limitations of safety. Both a seat harness and especially a chest harness have the dangerous potential of the wearer slipping out of the harness when a load is applied to the harness in an adverse direction. Each category of safety harness contains many different models that provide additional features such as fit and added padding for wearer comfort. For example, the construction of most seat harnesses produces a fixed distance between the waist belt and the leg loops which may not fit all wearers. All safety harnesses must be inspected regularly and can become weakened by general wear, excessive abrasion, ultraviolet exposure, an excessive load applied to it as occurs when the harness arrests a fall of the wearer, or a number of other factors. Therefore a safety harness's effective lifespan and ability to not fail if a large load is applied to the safety harness, such as when a fall by the wearer occurs, is dependent on the environment, the frequency of use, past falls arrested by that safety harness, and any other factors that may impact the effectiveness of the safety harness.

Current backpacks exist that are intended to be used with safety harnesses. Typically these backpacks have hip belts configured to be worn on the outside of the seat harness for ease of removing the backpack. These designs usually contain either: 1) a webbing hip belt without padding that is reliant on the padding in the seat harness, 2) a padded hip belt that is shaped to reduce interference when worn with a seat harness, or 3) a standard padded hip belt. Unfortunately, each of the above designs is inherently disadvantageous. For example, a backpack that replaces a padded hip belt for an unpadded webbing hip belt when worn with a seat harness reduces the wearer's comfort when carrying the backpack. A backpack with a padded hip belt, even when shaped to reduce interference, worn with a seat harness can result in painful pressure points where the safety harness is pressed into various sensitive areas of the wearer such as the protruding section of the hipbones. These backpack designs generally incorporate features that can be used with seat harnesses but not with chest harnesses or full body harness.

U.S. Pat. No. 4,318,502 describes an integrated backpack and seat harness system that is intended to provide comfort to the wearer. The backpack is designed to release from the integrated hip belt and seat harness by utilizing a webbing loop permanently attached to the harness that attaches and detaches from the backpack. The connection configuration relies on a flexible webbing link between the hip belt and the backpack frame. This design reduces the effective load transfer to the hip belt and results in a stronger reliance on the user's shoulders for load bearing, as opposed to the user's hips. Likewise the disadvantageous configuration prevents the backpack's weight from remaining close to the wearer's body. Additionally, if the user desires the protection of a seat harness, the user must use the included seat harness to utilize the integrated hip belt and seat harness. This results in no personal choice for fit or additional comfort features of the seat harness for the wearer. Additionally, if the integrated hip belt and seat harness's integrity is damaged by any means, such as an arrested fall, abrasion, or frequency of use, the function of the seat harness in the integrated hip belt/seat harness has failed and the entire integrated hip belt/seat harness will require replacement to reduce risk to the wearer due to safety harness failure.

The use of a backpack and seat harness is also potentially dangerous as the seat harness suspends the user mainly by the legs and waist, while the backpack provides additional mass around the upper body. Wearing a seat harness and backpack while suspended by the seat harness can result in the wearer rotating from an upright position to a position with the wearer's head lower than the seat harness. The resulting position places the wearer in an awkward position that is difficult to maneuver out of, and enhances the likelihood of the wearer slipping out of the seat harness or suffering bodily harm. A common method used to prevent this scenario is for the wearer to use a load bearing chest harness (the remainder of this document will refer to a load bearing chest harness as a "chest harness") in combination with the seat harness. Generally the chest harness is not used to arrest the fall, but maintain the wearer in an upright position after the seat harness has arrested the fall. The chest harness is a separate entity from the backpack; the backpack shoulder straps are not designed to withstand the forces that occur from a fall arrest

and will likely fail if used as a chest harness. The wearer must foresee the need of a chest harness before he/she is in an adverse situation, otherwise the entire backpack must be removed to put the chest harness on, placing all items, including essential items such as first-aid kits, in the backpack at risk of falling out of reach such as if necessary items fall off of a cliff. Furthermore, light weight chest harnesses are generally constructed by the wearer out of tubular webbing and when worn next to the body as necessary for proper fit, may become uncomfortable while wearing a pack for extended periods of time due to restricted movement and taut edges pressing into the wearer's back and shoulders.

Accordingly, there is a need in the art for new backpack assemblies that allow a user to releasably attach to and support the backpack with a typical seat harness and can be used with or without a comfortable, functional chest harness. One objective of the teachings herein is to provide backpacks that can be integrated with any available seat harness, and maintain desired backpack qualities when no harness is used (e.g., load transfer directed to the hips, and a padded hip belt) and gives the user the option of replacing or exchanging the seat harness. Further objects herein allow a user to use an "intermediary connector", which includes hip belts and backpack supports, with any available seat harness to attach to and support a loaded backpack. Still further embodiments are directed to backpacks incorporating a removable chest harness.

SUMMARY OF THE INVENTION

The embodiments provided herein include improvements over previous backpack and seat harness arrangements and over previous integrated hip belt/seat harness and backpack arrangements. The teachings herein allow for any seat harness to be integrated with a backpack's hip belt to maintain comfort over separate hip belt and off-the-shelf harness arrangements and to permit the user to wear the best personally suited off-the-shelf seat harness available with respect to fit, comfort, and safety. In preferred embodiments, the integrated seat harness/hip belt arrangement quickly releases from the backpack while being worn yet when connected provides a stiff connection to the backpack, producing a more comfortable and maneuverable backpack by transferring the backpack load to the off-the-shelf seat harness/hip belt effectively and maintaining the backpack load position close to the wearer's back. Furthermore, a removable chest harness can be integrated into the backpack to significantly reduce risk to the user from adversely rotating such that his/her head is below the seat harness as may occur during a fall, ascending, or descending of a rope. The chest harness can be removed to reduce weight at the wearer's discretion. According to additional embodiments, the chest harnesses herein can be constructed into the backpack such that a fall will not impact vital portions of the backpack's construction such as the backpack's ability to carry loads in the internal backpack compartment.

According to further embodiments, the chest harnesses provided herein can be easily put on by the wearer without the wearer removing the backpack and placing vital items at risk of falling out of reach of the wearer such as off of a cliff. The design of the chest harnesses herein also allows a user to comfortably wear the chest harnesses with a backpack.

Preferred embodiments are directed to a backpack assembly having a main storage enclosure and means for releasably attaching to a hip belt, wherein said hip belt includes means for releasably attaching to said main storage enclosure and is constructed from an outer layer of material and an inner layer of material attached together to form an internal hollow channel configured to releasably thread a seat harness through. The channel can be enclosed or partially enclosed (e.g., non-continuous) such that the inner and/or outer layer is made with loops, for example.

More specific embodiments are directed to hip belt assemblies wherein said outer layer and inner layer are constructed of fabric, and/or rigid material. It is preferred that the inner layer is not rigid, however. Further embodiments allow for the outer layer and inner layer of material to be sewn together, to form said channel.

Additional embodiments include the main storage enclosure and said hip belt further comprise means for transferring the weight load from the backpack to the hip belt. Said means can include a rigid support, for example. Advantageously, the rigid support can include a rigid frame member attached to the main storage enclosure and configured to engage with a connective member located on the hip belt. In further embodiments, the frame member can include a connective sheath, and said connective member on the hip belt can be a connective rod configured to fit within said connective sheath. In other preferred embodiments, the connective sheath can include an attached spring configured to releasably apply pressure to a latched connective rod when said connective rod is positioned upward into said connective sheath. Additionally, the frame member can include a connective rod, and said connective member on the hip belt can be a connective sheath configured to receive and support said connective rod. Furthermore, said connective sheath can include an attached spring configured to releasably apply pressure to a latched connective rod when said connective rod is positioned downward into said connective sheath.

Further embodiments are directed to a backpack assembly having a main storage enclosure and means for releasably attaching to a backpack support, wherein said backpack support includes means for releasably attaching to and means for supporting said main storage enclosure and is configured to attach to a seat harness. Preferred means for supporting said main storage enclosure include a connective member configured to operably connect with and support a frame member on the main storage enclosure, for example. Additionally the frame member can include a connective sheath, and said connective member on the backpack support include a connective rod configured to fit within said connective sheath. In additional embodiments, the connective sheath can include an attached spring configured to releasably apply pressure to a latched connective rod when said connective rod is positioned upward into said connective sheath. Additionally, the frame member can include a connective rod and said backpack support can include a connective sheath configured to receive and support said connective rod. Furthermore, said connective sheath can include an attached spring configured to releasably apply pressure to a latched connective rod when said connective member is positioned downward into said connective sheath. Additional means for supporting said main storage enclosure comprises a mount configured to operably connect with and support a mating connecter attached to the main compartment. Preferably, the mount can include a plurality of hinged gates, configured to receive a mating connector attached to said main storage enclosure.

Further embodiments herein are directed to backpack assemblies having an opening configured to allow a user to position a chest harness behind a layer of material positioned to abut against a user's back when worn and a plurality of openings configured to allow said user to access and secure chest harness on their body while wearing said backpack assembly. Preferably said layer of material is a pocket con-

structed from fabric and configured to receive back padding. Preferably, said opening is located on said pocket and can be configured such that a user can place and remove a chest harness between the pocket and the main storage enclosure of the backpack. According to more specific embodiments, the pocket can be sewn substantially around its perimeter to attach to said main storage enclosure, and is configured, in combination with the chest harness, to suspend the weight of a loaded backpack assembly, and the user secured into said chest harness after a typical fall from a rope, without damaging the backpack assembly.

Further embodiments are directed to backpack assemblies comprising: a main storage enclosure and an intermediary connector configured to operably couple with a separate seat harness and having means for releasably attaching to and supporting the main storage enclosure. The intermediary connecter can be a hip belt or a backpack support. Preferred means for supporting the main storage enclosure can include a rigid frame member attached to the main storage enclosure and configured to engage with a pocket located on the intermediary connector. Preferred assemblies include means for supporting the main storage enclosure and can include a plurality of rigid frame members attached to the main storage enclosure and configured to engage with a plurality of pockets located on the intermediary connector.

Backpack assemblies herein can also comprise a layer of material positioned to abut against a user's back when worn, wherein said layer of material comprises an opening configured to allow a user to insert and remove a chest harness behind said layer of material and further include a plurality of openings configured to allow said user to access and secure the inserted chest harness on their body while wearing said backpack assembly. Preferably, the layer of material is a pocket constructed from fabric and configured to receive back padding. Additionally, the pocket can be sewn substantially around its perimeter to said main storage enclosure, and can be configured to allow an inserted chest harness to suspend the combined weight of a loaded backpack assembly and a user without damaging the backpack assembly.

The intermediary connector can be a backpack support and the means for supporting the main storage enclosure can include a pocket on the backpack support configured to engage with a frame member attached to the main storage enclosure. Other advantageous means for supporting said main storage enclosure can include a mount having a plurality of hinged gates, configured to receive a mating connector.

Further embodiments are directed to backpack assemblies having a main storage enclosure having means for releasably attaching to a hip belt constructed from a bottom panel of pliable material hinged to a top panel of pliable material such that the bottom and top panels can fold together and unfold away from each other to allow for the removable insertion of a separate seat harness between said bottom and top panels. Preferably, the top and bottom panels can include means for releasably attaching to each other when said panels are folded together. Additionally, the top panel can include a plurality of flaps wherein at least one flap comprises a releasable fastener configured to couple with a releasable fastener on said bottom panel when the top and bottom panels are folded together. In other embodiments, at least one of said panels comprises a buckle configured to releasably attach to the other panel when said top and bottom panels are folded together. Preferably, at least one of said bottom and top panels includes padding. The backpack assembly can also include means for transferring the weight load, such as a rigid frame member attached to the main storage enclosure and configured to engage with a pocket located on the hip belt.

Furthermore, the means for transferring the weight load can comprise a plurality of rigid frame members attached to the main storage enclosure and are configured to engage with a plurality of pockets located on the hip belt.

Further backpack assemblies can include a main storage enclosure coupled to a hip belt constructed from an inner panel of pliable material coupled to an outer panel of pliable material such that said outer and inner panel of the hip belt define a space configured to allow for the removable insertion of a separate seat harness. Alternatively, one or more of the panels can include a non-continuous material, such that there are one or more openings in the panel. Hip belts herein can further include means for transferring the weight load of the main storage enclosure to the hip belt, including one or more rigid frame members attached to the main storage enclosure configured to engage with one or more pockets located on the hip belt.

BRIEF DESCRIPTION OF THE DRAWINGS

It will be appreciated that the drawings are not necessarily to scale, with emphasis instead being placed on illustrating the various aspects and features of embodiments of the invention, in which:

FIG. **1** is a perspective view of a backpack and hip belt.

FIG. **2** is an exploded view of a backpack showing an integrated chest harness behind the pocket.

FIG. **3** is a perspective view of a backpack detached from the hip belt.

FIG. **4***a* is a close-up view of an unengaged coupling mechanism between a hip belt and the backpack.

FIG. **4***b* is a close-up view of an engaged coupling mechanism between hip belt and the backpack.

FIG. **5***a* is a perspective view of a hip belt detached from a backpack.

FIG. **5***b* is an exploded view of a hip belt detached from a backpack.

FIG. **5***c* is a perspective back view of a preferred hip belt opened and configured to receive a seat harness.

FIG. **5***d* is a perspective back view of a preferred hip belt, closed and without a seat harness.

FIG. **5***e* is a perspective front view of a preferred hip belt enclosing a seat harness.

FIG. **6***a* is a perspective view of a common seat harness that can be used with the novel intermediary connectors described herein.

FIG. **6***b* is a side perspective view of a common seat harness that can be used with the novel intermediary connectors described herein.

FIG. **7** is a perspective view of a common seat harness integrated with a hip belt.

FIG. **8** is a perspective view of a chest harness that can be integrated with the backpacks described herein.

FIG. **9** is a perspective view of an alternative chest harness that can be integrated with the backpacks described herein.

FIG. **10***a* is a close-up view of an alternative unengaged coupling mechanism between a hip belt and the backpack.

FIG. **10***b* is a close-up view of an alternative engaged coupling mechanism between a hip belt and the backpack.

FIG. **10***c* is a close-up view of an alternative engaged coupling mechanism between a hip belt and the backpack.

FIG. **11***a* is a perspective view of a backpack support that allows a common seat harness to attach to and support a backpack, without the use of a hip belt.

FIG. **11***b* is a perspective view of a backpack support integrated with a common seat harness and detached from a backpack.

FIG. **12***a* is a perspective view of an alternative backpack support that allows a common seat harness to attach to and support a backpack, without the use of a hip belt.

FIG. **12***b* is an orthogonal side view of an alternative backpack support that allows a common seat harness to attach to and support a backpack, without the use of a hip belt.

FIG. **12***c* is an orthogonal top view of an alternative backpack support that allows a common seat harness to attach to and support a backpack, without the use of a hip belt.

FIG. **12***d* is an orthogonal top view of an alternative backpack support and connective member that can be used to attach a common seat harness to a backpack, without the use of a hip belt.

FIG. **12***e* is a perspective view of a connective member that can be used with a backpack support that allows a common seat harness to attach to and support a backpack, without the use of a hip belt.

FIG. **12***f* is a perspective view of a top-gate.

FIG. **12***g* is a perspective view of an alternate backpack support and a connective member.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Embodiments of the present invention are described below. It is, however, expressly noted that the present invention is not limited to these embodiments, but rather the intention is that modifications that are apparent to the person skilled in the art and equivalents thereof are also included.

Backpacks

FIG. **1** depicts a perspective view of a preferred backpack **20** and hip belt **18**. The backpacks **20** and harnesses provided herein can readily be adapted and/or interchanged to non-exclusively work with either a first hip belt **18** or a preferred folding hip belt **174** (FIGS. **5***c*-**5***e*). Accordingly description related to the first hip belt **18** is also intended to apply to the folding hip belt **174**, and vice versa. According to advantageous embodiments, the backpacks **20** described herein are preferably pliable with minimal frame structure. While the backpacks **20** provided herein can be constructed using any suitable method, frame structure, and material in the industry, it is preferred that the backpacks described herein be constructed primarily from nylon fabric. Other preferred materials of the backpacks described herein can non-exclusively include HYPALON®, CORDURA®, GORTEX®, closed cell foam or other padding, polyester fabric, and plastic.

Preferred backpacks will have first and second shoulder straps, also referred to as "shoulder pads", **22** and **24**. Typically, shoulder straps **22** and **24** are tightened and loosened by adjusting the length of their respective webbing **30** and **32**, through their respective buckles **26** and **28**. According to this embodiment, it is preferred that the webbings **30** and **32** are constructed from nylon webbing, but can be made of any pliable and strong material. In further embodiments, it is preferred that buckles **26** and **28** are plastic ladder lock buckles, but can be any suitable buckle that allows the user to securely adjust the length of webbings **30** and **32**. Buckles **26** and **28** can be securely attached to their respective shoulder straps **22** and **24** by any suitable method, including stitching, for example.

In further embodiments, the shoulder straps **22** and **24** can be reinforced with webbing **34** and **36**, respectively. The shoulder straps **22** and **24** and/or the webbing **34** and **36** can also include removable or non-removable gear loops for attaching hiking or climbing equipment, such as spring-loaded camming devices, passive rock climbing protection devices, chalk bags, carabineers, and the like, for example. These gear loops can either be load bearing or non-load bearing depending on the needs of the user. In other embodiments the shoulder straps **22** and **24** are not reinforced with webbing. According to preferred embodiments, the webbings **34** and **36** can nonexclusively be constructed from nylon webbing, or other suitable, strong, and pliable material.

It is additionally advantageous to have the backpacks provided herein include stabilizer straps **43** and **45** attached to their respective shoulder straps **22** and **24** or webbings **34** and webbing **36**. According to advantageous embodiments, the stabilizer straps **43** and **45** are constructed from nylon webbing, or from other suitable, pliable, and strong material. The length of stabilizer straps **43** and **45** are preferably adjustable by buckles **44** and **46**. In further embodiments, it is preferred that buckles **44** and **46** are plastic ladder lock buckles, but can be any suitable buckle that allows the user to securely adjust the length of the stabilizer straps **43** and **45**. Buckles **44** and **46** can be securely attached to the backpack **20** by any suitable method, including stitching, for example.

In additional embodiments, the shoulder straps **22** and **24** are kept in a more comfortable position by a sternum strap **42**. With respect to this embodiment, the sternum strap **42** is preferably constructed from nylon webbing and configured to quickly release, through the use of a buckle, or other suitable quick release means. In alternative embodiments, the sternum strap **42** can be constructed from any suitable, strong, and pliable material. In more specific embodiments, the sternum strap **42** can be secured to webbings **34** and **36** by plastic three-way connectors **38** and **40**, respectively, but any suitable method to connect the sternum strap **42** to webbings **34** and **36** can be used.

In further preferred embodiments the backpack includes a flap **48** configured to conceal and secure the contents within the backpack **20**. The flap **48** can be attached to the backpack **20** by any suitable method commonly known in the industry. In preferred embodiments, the flap **48** is hinged to the top of the backpack **20**, to allow the user to easily expose and conceal the backpack's **20** contents. According to preferred embodiments, the flap **48** is constructed of water resistant coated nylon, ordinary nylon fabric, HYPALON®, CORDURA®, and/or GORTEX®, or any other suitable material. In other embodiments, the backpack **20** can utilize a drawstring closure to conceal the contents within the backpack.

According to preferred embodiments the backpacks **20** provided herein can include a pocket **70**. FIG. **2** depicts an exploded view of a preferred backpack **20**, where the pocket **70** has been removed from backpack **20** to expose the internal chest harness **13**. In certain embodiments, the pocket **70** includes a front layer of fabric configured to abut against the user's back when worn and stitched to a back layer of fabric configured to be positioned against the backpack **20**. In other embodiments, the pocket is a single layer of fabric. In more specific embodiments, the pocket **70** can include an upper portion and a bottom portion, separated by a slit **71** that traverses across the pocket **70** laterally. In certain embodiments, the slit **71** cuts through both the front and back layers of fabric that make up the pocket **70**. This preferred configuration, allow a user to place a chest harness **13** through the slit **71** in order to position a chest harness **13** between the back layer of the pocket **70**, and the backpack **20**. The slit **71**, likewise allows a user to remove the chest harness **13** from behind the pocket **70**. This embodiment is especially advantageous should the user desire to replace a worn chest harness, or simply needed a different size or comfort level.

In even more specific embodiments, the inside of the pocket **70** is preferably hollow to allow a user to stuff padding inside. Preferred padding includes closed cell foam. As the

padding is pliable, the user can bend the top of the padding and push it through the slit **71** in order to position it within the pocket **70**. Once inside the pocket **70**, the padding can be straightened from its bent configuration to fill the top portion of the pocket **70**, above the slit **71**.

In even more preferred embodiments, the pocket **70** is stitched substantially around its perimeter to the backpack **20**. In more specific embodiments, there are small, unstitched openings in the top of the pocket **70**, near the shoulder straps **24** and **22** (or in another suitable location) to allow the ends **68** and **64** of the chest harness **13** to pass through. FIG. **1**, where chest straps **12** and **16** are exposed, depicts a preferred location for the top openings on the pocket **70**. The top openings are preferably between 1 and 2 inches in length, and more preferably about 1.5 or 1.2 inches in length, but can be any suitable distance. Additionally, it is preferred that the pocket **70** includes two openings **74** and **72** in the lower portion, configured to allow the pulling segments **14** and **10** of the chest harness **13** to pass through.

One main goal of the teachings herein is to provide backpacks **20** configured to detach from a supporting hip belt **18** and **174** that is integrated with a removable seat harness **121**. According to non-preferred methods, 1 or more (e.g., 2, 3, or 4) internal frames **84** and **82** can be located within the main compartment of the backpack **20**, but are preferably positioned externally to the main compartment, more specifically between the pocket **70** and the main compartment. Those with skill in the art will readily appreciate other locations for the 1 or more internal frames. The internal frames **84** and **82** are preferably made of a rigid, strong material, such as carbon fiber, plastic, or metal (e.g., aluminum, titanium, etc), for example. Preferred rigid internal frames can be tubing with polygonal, rectangular, circular or other cross-sectional shape, a sheet, or any other configuration that will support the backpack **20**. According to more preferred methods, the internal frames **82** and **84** are made of fiberglass cylindrical tubing. According to further embodiments, the internal frames **82** and **84** can be held in place within the backpack **20** by two sewn enclosures vertically traversing along the length of the frames **82** and **84**, or by other suitable means. The sewn enclosures are preferably made using nylon material, including nylon webbing; however any suitable material can be used, including plastic, for example.

According to further embodiments, the ends of the internal frames **82** and **84** can be attached to connective sheaths **76** and **78** that are exposed at the bottom of the backpack **20**, and configured to mate with connective rods **86** and **88** located on the hip belt **18**. In more specific embodiments, the connective sheaths **76** and **78** can be constructed from aluminum cylindrical tubing, or other suitable material including steel alloy, for example, and can be attached to the ends of the internal frames **82** and **84** by epoxy. Other suitable means for attaching the connective sheaths **76** and **78** to the internal frames **82** and **84** can be used, including further adhesives. In more specific embodiments, the connective sheaths **76** and **78** can protrude underneath the pocket of the backpack **20** through reinforced holes in the fabric, by approximately an inch.

FIGS. **4***a* and **4***b* depict a connective sheath **76** mating with its respective connective rod **86**. While only depicting one internal frame **82**, connective sheath **76**, and connective rod **86**, the configurations provided in FIGS. **4***a* and **4***b* are also applicable to a second internal frame **84**, connective sheath **78**, and connective rod **88**. The connective rods **86** and **88** can be cylindrical in shape, having a smaller outside diameter than the inside diameter of their respective connective sheath **76** and **78**. Other geometrical shapes of complementary sheaths and rods are also contemplated herein, including square, polygonal, and rectangular, for example. It is also expressly contemplated that the locations of the sheaths and connective rods can be switched such that the connective rods are located on the internal frames, and the connective sheaths or pockets are attached to the hip belt, as shown in FIGS. **5***c* and **5***d*. According to more specific embodiments, the internal frames **82** and **84** can act as rods without sheaths and can be configured to slide into one or more complementary sheaths, or pockets **188** and **190**, on the hip belt. Preferred pockets can be made from any suitable pliable or non-pliable material, including fabric and plastic for example. In other embodiments, the internal frame can be a sheet configured to slide into a wider sheath or pocket.

It is preferred that when a connective sheath **76** or **78** mates with its respective connective rod **86** and **88**, the rod abuts against its respective internal frame, as shown in FIG. **4***b*. In other embodiments, the connective rod **86** or **88** does not abut against its respective internal frame **82** and **84**. In other preferred embodiments, the connective sheaths **76** and **78** do not have to be entirely hollow, and can have a raised internal shoulder or a solid center for the internal frames **82** and **84** and the connective rods **86** and **88** to abut against.

In further embodiments, the backpacks provided herein can also include a buckle member **80** configured to attach to a complementary buckle member **90** that is attached to outer layer of a hip belt **18** and **174** as shown in FIGS. **5***a*-**5***e*. This buckle member **80** is advantageous as it can help the backpack from separating from the hip belt and/or dislodging the connective rods **86** and **88** from their respective connective sheaths **76** and **78** or internal frames **82** and **84** from their pockets **188** and **190**. Any suitable quick release couplers can be used to maintain the connective rods **86** and **88** inside their respective connective sheaths **76** and **78** or internal frames **82** and **84** within their pockets **188** and **190**.

Chest Harnesses

According to advantageous embodiments, the backpacks provided herein can include a chest harness **13** configured to attach to a safety rope and having sufficient load bearing strength to prevent the user from hanging in an upside down position after a fall. According to more specific embodiments, the chest harnesses **13** described herein can include two intertwined chest straps **12** and **16**, as shown in FIG. **2**. More specifically, it is preferred that each chest strap **12** and **16** has a buckle (**64** and **68** respectively) located at one end of the strap, and a pulling segment (**10** and **14** respectively) at the opposite end of the strap. According to preferred embodiments, it is preferred that the chest straps **12** and **16** are constructed of tubular nylon webbing; however any suitable, pliable, and strong material can be used. According to preferred embodiments, the chest harness buckles **64** and **68** are load bearing aluminum buckles; however other suitable load bearing buckles can be used.

In preferred embodiments, a first chest strap **12** traverses between a shoulder pad **22** and backpack **20**, and under the pocket **70** that holds the back padding. Likewise, a second chest strap **16** traverses between a shoulder pad **24** and backpack **20**, and under the pocket **70** that holds the back padding, such that it intertwines one ore more times (e.g., 2, 3, 4, 5, 6, and 7) with the first chest strap **12** behind the pocket **70**. Alternatively, the first chest strap **12** and/or second chest strap **16** can pass through a hole in shoulder strap **22** and/or shoulder straps **24**, or a hole in backpack **20** or pocket **70** (Not shown). According to preferred embodiments, the chest straps **12** and **16** can be either permanently or releasably attached by known means to the shoulder straps **22** and **24**, the backpack **20**, or the pocket **70**, or any other reasonable place to attach chest strap **12** and/or chest strap **16**.

According to preferred embodiments, the shoulder pads **22** and **24**, are sewn to the backpack **20** and the pocket **70** configured to hold the back padding, is sewn to the backpack **20** afterwards.

According to preferred embodiments, the chest straps **12** and **16** are permanently sewn to buckles **64** and **68** respectively. Additionally, other methods of load-bearing permanent and temporary attachment can be used. In addition to having the buckles **64** and **68** strongly attached to the chest straps, it is also highly advantageous for the pulling segments **14** and **10** to be releasably, yet strongly attached to a one or more buckles **68** or **64** when the chest harness **13** is secured to the user. Each of the pulling segments **10** and **14** can be securely attached to either buckle **68** or **64**, such that the configuration can sufficiently prevent a user from hanging upside down after a fall. To obtain a more secured fit, the user can thread the pulling segments **14** or **10** back through their respective buckles **68** or **64** a second time; a configuration typically referred to as a "double back".

In other embodiments, it is preferred that the chest strap buckles **68** and **64** are exposed near the top of the backpack **20**, such that a user can readily thread the pulling segments **14** and **10** of the chest straps through their respective buckles (**68** and **64**). According to more specific embodiments, the pulling segments **14** and **10** are exposed through holes **74** and **72**, respectively. The holes **74** and **72** are preferably located at a convenient location on the pocket **70**, nonexclusively including below the user's armpit, such that when the chest harness **13** is worn, it provides a secure and snug fit and the pulling segments **14** and **10** hang below the holes **74** and **72** and are readily accessible by the user's hands. The perimeters of the holes **74** and **72** can be reinforced with either plastic or additional layers of fabric to prevent the straps **12** and **16** from tearing the material of the pocket **70** or the back padding. While shown in the figures as having the buckles **68** and **64** at the top of the chest straps, this orientation is expressly nonlimiting and can readily be reversed, such that the buckles **68** and **64** are at the bottom of the chest harness **13** and pass through the lower openings **74** and **72** on the pocket **70**.

According to other alternative embodiments, the chest strap buckles **68** and **64** can readily be substituted with other suitable means for securing and adjusting the chest straps **12** and **16**. Preferred means can include looping each end of the chest straps **12** and **16** and pulling segments **10** and **14** and connecting them by a load bearing carabineer. Alternative preferred means can include using other rigid or pliable connectors, such as a load bearing knot, for example.

Yet another embodiment includes attaching the chest harness **13** with the shoulder straps **22** and **24**. According to this embodiment, the sternum strap **42** can be made of any load bearing strap material such as tubular nylon and the quick release buckle on sternum strap **42** is able to remain connected under high loads. An example of a suitable buckle on the sternum strap would be a metal parachute quick release harness buckle. Furthermore, in this embodiment, the shoulder strap buckles **26** and **28** are either not present or are capable of withstanding high loads. One nonexclusive example of a buckle suitable for these conditions is a metal load bearing buckle.

According to further embodiments, it is desirable that the backpack **20**, pocket **70**, and holes **74** and **72** are configured such that a user can readily replace said chest straps **12** and **16** and the back padding. This configuration is highly advantageous; especially if the user is concerned that the straps **12** and **16** have excessive wear on them, or if it is desirable to accommodate different sized users. Other advantages include allowing the user to replace or wash the back padding inside the pocket **70** or to use the back padding as a seat cushion and/or insulation from the ground.

While the chest straps **12** and **16** are depicted in FIG. **2** as intertwining, this is expressly a non-limiting embodiment. More specifically, the chest straps **12** and **16** can be directly attached to each other, through any suitable method including double stitching, hot gluing, such that they maintain sufficient load bearing strength to prevent a user from hanging upside down after a fall. Alternatively, and as shown in FIG. **9**, the chest straps **12** and **16** can be connected together by one or more (e.g., 2, 3, 4, 5, or 6) rigid or pliable cross pieces **125**. The one or more cross pieces **125** can be made of any suitable strong material (e.g., tubular nylon) and can be connected to the straps **12** and **16** by any suitable method including double stitching, hot gluing, such that the straps **12** and **16** maintain sufficient load bearing strength to prevent a user from hanging upside down after a fall.

In another embodiment, the chest harness **13** can include webbing or rope loops attached to pulling segments **10** and **14** to form a device commonly known as a gear sling. When pulling segments **10** and **14** are secured to buckles **64** and **68**, the loops can hang between the user's chest and holes **72** and **74**. Additional safety gear commonly used for climbing such as spring-loaded camming devices, passive rock climbing protection, and/or carabineers can be attached to these loops for easy accessibility.

The chest harnesses **13** depicted in FIGS. **8** and **9** can readily be integrated with the backpacks **20** described above and as depicted in FIG. **2**. The above description on how the wearer applies, fastens, and uses the chest harness **13** is likewise applicable to the chest harnesses **13** depicted in FIGS. **8** and **9**.

According to preferred embodiments, the pulling segments **10** and **14** are fed over the wearer's chest and threaded through buckles **68** and **64** respectively. In more general embodiments, the user can utilize any suitable method to ensure that the pulling segments **10** and **14** do not slip through the buckles and support the necessary load, including tying the pulling segments **10** and **14** to the buckles **68** and **64**, or utilizing a "double back" strap feeding technique. According to another preferred configuration, the pulling segment **10** can be fed over the wearer's left arm and threaded through buckle **64** and chest strap **14** can be fed over the wearer's right arm and threaded through buckle **68**.

In advantageous embodiments, both chest straps **12** and **16** can be fed through a carabineer attached to a rope properly secured to the wearer's seat harness **121**. Preferably the carabineer includes a locking gate to ensure the gate will not open unexpectedly. Alternatively, the carabineer that locks the chest straps **12** and **16** can be attached to a webbing loop capable of withstanding a strong load and that is connected with a carabineer, preferably with a locking gate, to a rope properly secured to the seat harness **121**.

Hip Belts

The teachings herein are also directed to hip belts **18** and **174** that are configured to removably integrate with a typical seat harness **121** and attach to and support a backpack **20**. Preferred hip belts configured to integrate with a typical seat harness **121** and support a backpack are depicted in FIGS. **1**, **5***a*, **5***b*, **5***c*, **5***d*, **5***e* (integrated with a seat harness **121**) and in FIG. **7** (integrated with a seat harness **121**).

Hip belts **18** provided herein can include an outer layer **100** and an inner layer **98**. The terms "layer" and "panel" can be used interchangeably herein and can signify one layer or two layers of material. Layers and panels herein can be made of continuous and non-continuous material. More specifically, continuous material signifies that the layer or panel does not

have a significant opening or hole, while non-continuous material signifies that the layer or panel includes 1 or more openings or holes, and can be ventilated or include mesh for example. Both the outer and inner layer **100** and **98** can be made of 1 or more sheets of nylon fabric, for example. Preferred hip belts **18** and **174** include pliable material such as fabric, foam, reinforced foam, pliable plastic, or other suitable material. In certain embodiments, the outer layer and/or the inner layer individually include two sheets of nylon fabric sandwiching a dense layer of closed cell foam, or other padding. In other embodiments the inner layer **98** is attached (e.g., sewn) to the outer layer **100** to form a hollow channel **15** inside the hip belt **18**. More specifically, the inner and outer layer **98** and **100** can be generally rectangular in shape, slightly tapered at the ends, and substantially the same size, such that when sewn together along their longer sides, their shorter sides remain open. Other shapes of hip belts are expressly contemplated herein, including anatomically shaped hip belts that form to the user's hips, for example. The two openings along the shorter sides of the hip belt **18** allow the user to readily insert and remove the seat harness **121**, when desired. To integrate the seat harness **121** with the hip belt **18**, the user can thread one end of the seat harness **121** through the hollow channel **15** until it is exposed at the opposite end of the hip belt **18**. To remove the seat harness **121** from the hip belt, the user, after unbuckling the applicable buckles, can pull the appropriate end of the seat harness **121**. For ease of use, the webbing **118** and padding **120** of the seat harness **121** can be threaded through the hip belt, while the leg loops **102** and **104** and belay loop **114** remain outside the channel **15**. In more specific embodiments, and with reference to FIG. **6***b*, the seat harness **121** end opposite of buckle **116** is threaded though the channel **15** to integrate with the hip belt, as shown in FIG. **7**. Likewise, a user can pull on the buckle **116** to remove the seat harness **121** from the hip belt **18**.

FIGS. **5***c*, **5***d*, and **5***e* depict a preferred folding hip belt **174** to be used with the teachings herein. Preferably, the folding hip belt **174** includes a top panel **180** hinged or otherwise coupled to a bottom panel **182** along one of its sides and to one or more flaps (2, 3, 4, etc) **176** on an opposite side. In other embodiments, flaps **176** can be hinged to the bottom of bottom panel **182** and configured to releasably attach to the top panel **180**. Both the top panel **180** and the bottom panel **182** have internal and external sides. Preferably, the top panel **180** and/or bottom panel **182** individually include two sheets of nylon fabric sandwiching a dense layer of closed cell foam, or other padding.

The internal sides of these panels **180** and **182** fold in towards each other to close the hip belt **174** and while the external side of the top panel **180** faces the user's body when worn, while the external side of the bottom panel **182** faces away from the user's body when worn.

Preferably the top panel's **180** bottom side is hinged to the top of the bottom panel **182**, while the top side of the top panel **180** is hinged to one or more (e.g., 2, 3, 4) downward folding flaps **176** separated by a space **184** configured to allow the buckle **110** attached to the leg loops supports **106** and **108** on the seat harness **121** to pass through and connect to complimentary buckle **112** of seat harness **121**. Said one or more flaps **176** preferably include means for releasably fastening to the internal side of the bottom panel **182**. For example, as shown in FIG. **5***c*, the two flaps **176** include VELCRO® strips **178** or other hook and loop fasteners configured to releasably fasten to complementary fasteners **186** positioned on the inside of the bottom panel **182**. Any suitable releasable fastener besides hook and loop fasteners can be used, non-exclusively including buttons, snaps, zippers, laces, and buckles for example. When the top panel **180** and bottom panel **182** are in an open position (as depicted in FIG. **5***c*) they define a cavity configured to hold a seat harness **121**. Preferably a user can place the seat harness **121** into the opened hip belt **174** between the inside of the top panel **180** and the undersides of the flaps **176**. With the seat harness **121** positioned between the inside of top panel **180** and the undersides of the flaps **176**, the top panel **180** can then be folded downwards towards the bottom panel **182**, such that the fasteners **178** on the flaps **176** securely fasten to the complementary fasteners **186** on the internal side of the bottom panel **182** and releasably secure the seat harness **121** within the hip belt **174**.

When the seat harness **121** is secured with the hip belt **174**, it is preferred that the flaps **176** are positioned between the seat harness **121** and the bottom panel **182** (outer panel) instead of between the seat harness **121** and the top panel **180** (inner panel). This prevents the flaps **176** from increasing the circumference that the seat harness **121** wraps around. In contrast, if the flaps **176** were positioned disadvantageously between the secured seat harness **121** and the inner panel (top panel **180**), a user may need to obtain a longer seat harness **176** to accommodate the increased circumference the flaps **176** would be adding. Preferably, the folding hip belt **174** is configured to allow a user to easily and quickly insert and remove a seat harness **121**. In other embodiments, the hip belt **174** does not contain flaps **176**. In this embodiment the top panel **180** and bottom panel **182** may or may not releasably attach from each other. Means for releasably attaching to each other may include but are not limited to VELCRO®, other hook and loop fasteners, and buckles, where buckles may be located on one or both panels.

Additional embodiments are directed to hip belts having two panels that can completely detach and attach to each other to allow for the insertion and removal of the seat harness **121**. With respect to this embodiments, the hip belt **18** or **174** can be configured to be completely removable from the backpack **20** or according to more specific embodiments, the backpack **20** can be configured to be non-releasably attached to the outer layer **100** of the hip belt **18** or the bottom panel **182** in hip belt **174** while the inner layer **98** or the top panel **180** can be configured to completely detach from the outer layer **100** and the bottom panel **182**, respectively. This particular embodiment allows the user to remove the backpack **20** while still wearing the seat harness **121** and maintain the inner layer **98** or the top panel **180** secured between the seat harness **121** and the user which allows easier attachment of the outer layer **100** or the bottom panel **182** at a later time. To facilitate these embodiments, one or more panels or layers can include a releasable fastener such as VELCRO® or other hook and loop fasteners, button, zippers, snaps, buckles, and the like to allow for complete separation from each other.

It is preferred that the hip belts **18** and **174** provided herein include complementary buckle members **58** and **59** that allow the user to readily close and open the hip belts **18** and **174** when putting it on and removing it. Buckle member **59** allows the length of webbing **62** to be adjusted to accommodate the waist size of various users. Other embodiments include complementary buckle members **58** and **59** where the length of webbing **62** is adjusted with a ladder lock buckle attached to hip belts **18** and **174** near the attachment of webbing **62** to hip belts **18** and **174**, and in further embodiments, the location of buckle member **58** is adjusted with a ladder lock buckle attached to hip belts **18** and **174** in a similar fashion. According to advantageous embodiments, it is preferred that the webbings **60** and **62** are sewn to the outer layer **100** or external side of the hip belt **18** and **174** and constructed from nylon, but

can be made of any pliable and strong material. In other embodiments, the hip belt can include a buckle member **96** configured to releasably attach to a complementary buckle member **110** of the seat harness **121** for support of the leg loops **102** and **104**.

According to more specific embodiments, the hip belts **18** and **174** includes buckle members **54** and **56** that are respectively complementary to buckle members **50** and **52** located on the backpack **20**. Additional buckle members (e.g., 1, 2, 3, or 4) can also be attached to the hip belt **18** and **174**, such as buckle member **90** that is complementary to buckle member **80** on the backpack **20**. Additional buckle members, such as buckle member **90** are preferably attached to the hip belt by webbing **101**. Together these buckle members form a quick release mechanism to easily detach the backpack **20** from the hip belt **18** and **174**. Buckle members **54**, **56**, and **90** are preferably attached to the hip belt **18** and **174** by nylon webbing **53**, **55**, and **101**, respectively, or by other suitable means. The webbing on the hip belt can preferably be adjusted, through the buckles members **54** and **56** to tighten the fit between the hip belt and the backpack, and through buckle member **59** to tighten the fit around the user's waist, such that the weight is centered on the user's hips.

As discussed above, the hip belts herein **18** and **174** can include connective rods **86** and **88** that are configured to mate with the connective sheaths **76** and **78** attached to the internal frames **82** and **84** in the backpack **20**. In further advantageous embodiments, the connective rods **86** and **88** can be encased by pockets **92** and **94**, respectively. The pockets can be attached to the outer layer **100** or external side of the hip belt **18** and **174** by any method known in the industry, including being sewn. In more specific embodiments, the connective rods **86** and **88** are preferably wide, or flare out, at their bottom ends to limit movement within the pockets **92** and **94**, respectively. Additional suitable means of securing the bottoms of the connective rods within their respective pockets can also be used by themselves or in conjunction with widening the bases, including adding an adhesive, for example.

As discussed above in detail, this configuration can readily be reversed such that the internal frames **82** and **84** act as connective rods and are configured to fit within pockets **188** and **190** positioned on the hip belt. Additionally the hip belt can contain 1, 2, 3, 4, or more connective rods, sheaths, or pockets and the backpack can contain the equivalent number of complementary sheaths, rods, or pockets. In other embodiments, the internal frame can have connecting segments, including a sheet that is configured to fit within a wider pocket on the hip belt.

When a user desires to remove the backpack **20** from their body in order to access the contents, they can disconnect the quick release members **54**, **56**, and **90** from complementary quick release members **50**, **52**, and **80** respectively. The user can then shrug their shoulders and provide any additional force with their arms to pull the sheaths **76** and **78** off of their respective rods **86** and **88**, or frame members **82** and **84** out of their respective pockets **188** and **190**. The user can then remove the backpack **20** by slipping the shoulder pads **22** and **24** off of the wearer's shoulders while still wearing the integrated hip belt **18** and **174** and seat harness **121** and remain safe in the seat harness **121**, properly secured to a safety line.

In highly advantageous embodiments, the hip belts **18** and **174** provided herein are capable of working with any off-the-shelf seat harness **121**. Non-exclusive examples of seat harness **121** that can be used with the teachings herein include those depicted in FIGS. **5***e*, **6***a*, **6***b*, **7**, and **11***b*, for example. In general, a seat harness **121** can include two leg loops **102** and **104**, adjustable by their respective buckles **122** and **124**. The leg loops **102** and **104** are attached to each other and typically pass through a belay loop **114**. Additionally, the seat harness **121** typically includes webbing **118** that passes through a belay loop **114**. In general, the webbing **118** can be adjusted with a buckle **116** for fitting with the load bearing, double back method and is padded by padding **120**. The leg loops **102** and **104** are usually held up for comfort by leg loop supports **106** and **108**, respectively. The leg loop supports **106** and **108** typically attach to the webbing **118** by a quick-release buckle having complementary members **110** and **112**. The first complementary quick release buckle member **112** is usually attached to the webbing **118** by a haul loop **123**. The haul loop **123** is a reinforced loop able to haul additional weight or haul line/rope behind the user when they are moving up vertical terrain, and is preferably attached around the webbing **118** of the seat harness **121**. FIG. **6***b* depicts an opened off-the-shelf general seat harness **121** with a haul loop.

The wearer can wear backpack **20** and hip belt **18** as shown in FIG. **1**. According to certain embodiments, the backpack may or may not contain an integrated chest harness **13**. In further embodiments the user can configure the chest straps of the chest harness **13** such that they are out of the way, by tying them off, for example.

FIGS. **10***a*, **10***b*, and **10***c* depict an alternative coupling method between hip belt **18** and **174** and backpack **20**. According to this embodiment, the connection of backpack **20** to hip belt **18** and **174**, is obtained through the use of one or more (e.g., 2, 3, 4) latched rods **130** connected to the hip belts **18** and **174** and configured to mate with one or more (e.g., 2, 3, 4) sheaths **126** utilizing a spring **128**. According to this embodiment, it is preferred that two rods **130**, each having a latch **132**, are configured to mate with two sheaths **126** having springs **128** and are attached to two internal frames **82** and **84**. In preferred embodiments, the number of sheaths **126** corresponds to the number of internal frames **82** and **84** within the backpack **20**. As will be described below, because the spring **128** and latch **132** assemblies prevents the rods **130** from being displaced from the sheaths **126**, these embodiments can be used with or without the complementary buckle members **80** and **90**. The position of all means described herein for connecting the hip belts to the backpacks, including means for supporting the backpacks, can readily be reversed. For example, the position of the latched rods and sheaths can be switched such that the lateral rods are positioned on the backpack and the sheaths or pockets are positioned on the hip belts.

In preferred embodiments, the spring **128** is constructed such that it applies force to the latched rod **130** when mated with the sheath **126**. More specifically, it is preferred that when the sheath **126** and rod **130** are pushed together, the spring **128** slides over the front ramp of latch **132**. After the sheath **126** and latched rod **130** are fully mated as shown in FIGS. **10***b* and **10***c*, the spring **128** pushes against the rod **130** and the flat or undercut back-side of latch **132** thereby prevents the sheath **126** and latched rod **130** from separating. Similar to the first embodiment of non-latched rods **86** and **88**, described above, the latched rods **130** can abut against the internal frames **82** or **84**, or be configured in the other variations described above. Additionally this configuration can be reversed such that the latched rods **130** can be located on the backpack, connected to the internal frames **82** and **84**, and the sheaths **126** having springs **128** can be positioned on the hip belt.

To remove the latched rods **130** from the sheaths **126**, the wearer can preferably first release complementary buckle members **56** and **52** in addition to **54** and **50**. In embodiments, where two springs **128** are used, it is preferred that they face

inward toward each other. More specifically, the springs can be attached together by a rigid or pliable connector, (e.g., nylon webbing) and configured such that an upward force applied to the connector would open both springs **128** at least by a distance sufficient to allow both springs **128** to slide over their respective latches **132**. (Not shown).

At the same time the latches are released, the wearer can shrug their shoulders and apply any extra needed force with their hands to allow both latched rods **130** to separate from their respective sheaths **126**. Upon release, the backpack **20** can then be removed from wearer while the wearer can remain in his/her hip belt **18** and **174**/seat harness **121** that may or may not be secured to a safety line.

To put the backpack on again, the user can slide both arms through the appropriate shoulder pad **22** and shoulder pad **24** and connect complementary buckle members **56** to **52** and **54** to **50**. The wearer can then shrug their shoulders such that the 1 or more latched rods **130** slide into their respective 1 or more sheaths **126**. When the wearer stops shrugging their shoulders, the springs **128** can slide over the ramped part of both latches **132**, thereby locking the rods **130** into their sheaths **126** and thereby securing backpack **20** to hip belt **18** and **174**.

Backpack Supports

In addition to being able to attach to the hip belts **18** and **174** provided herein, in alternative embodiments backpacks **20** can also be configured to couple with backpack supports **170** and **172**. The term "intermediary connector" as used herein encompasses both hip belts **18** and **174** and backpack supports **170** and **172**. In contrast to hip belts **18** and **174**, backpack supports **170** and **172** are not configured to wrap around a user's waist. Backpack supports **170** and **172** are smaller than hip belts **18** and **174** and are preferably configured to only attach to a portion of a seat harness **121**. As FIGS. **11***a*-**11***b*, **12***a*-**12***b*, and **12***g* depict, preferred backpack supports **170** and **172** are configured to vertically wrap around the belt of the seat harness **121**.

FIG. **11***a* depicts an alternative embodiment for attaching a typical seat harness **121** to a backpack **20**. In this embodiment, the wearer does not use the hip belts **18** and **174** described above, but instead uses a standard off-the-shelf seat harness **121** integrated with one or more (e.g., 2, 3, or 4) backpack supports **170** to attach to and support the backpack **20**. In preferred embodiments, the backpack supports **170** can be used with the seat harnesses **121** described herein, including any available seat harness **121**.

According to advantageous embodiments, the backpack support **170** includes a support element **134** having a curved top to fit over the seat harness padding **120**, and can be made of any suitable rigid or semi-rigid material, including rigid plastic, aluminum, steel, or titanium, for example. Preferably, the backpack support **170** includes adjustable webbing **140** threaded through a buckle **138** to allow the user to tighten and loosen the support element **134** around the seat harness padding **120**. According, to advantageous embodiments, the webbing **140** connects the support element **134** to the padding **142**. Additional features can be added to the backpack support **170** to prevent lateral movement along the padding of the seat harness **121** by utilizing hook and loop fasteners such as VELCRO®, snaps, or other fasteners. For example, fasteners can be attached to the internal side of the support element **134** and/or padding **142** that are configured to couple with complementary fasteners on harness padding **120**.

The webbing **140** is preferably made of nylon webbing, though any pliable strong material can be used. In more specific embodiments, it is preferred that the backpack support **170** includes padding **142** (e.g., closed cell foam padding, or other padding) configured to be internally located on the seat harness **121**, to add comfort to the user. In other embodiments, the backpack support **170** does not include padding.

In further embodiments, the backpack support **170** can include a connective member **136** molded into a support base **135** on the support structure **134**. In more specific embodiments, the support base **135** can be a continuous piece integrated with the support structure **134**. Other suitable means for attaching the connective member **136** to the support structure **134** can be used, including welding, for example. In other embodiments, connective member **136**, support structure **134**, and support base **135** are one continuous piece of the chosen material.

In certain embodiments, the connective member **136** mates with a connective sheath **76** or **78** attached to an internal frame **82** or **84**. In more preferred embodiments the backpack support includes one or more pockets that are configured to engage with one or more internal frame members, such that the one or pockets can support a loaded backpack (not shown). If only a single pocket is used, it is preferred that it is configured to engage with a medially positioned frame member, or substantially so. If only one backpack support **170** is attached to the seat harness **121** it is preferred that the connective member **136** have sufficient load bearing strength to support a loaded backpack. The strength of the connective member **136** can be enhanced by increasing its diameter, reinforcing the support base **135** with additional materials, or using strong metals, for example.

In other preferred embodiments, two backpack supports **170** can be attached to a seat harness **121**, in order to provide additional support to the backpack **20**. According to this embodiment, the two connective members **136** would individually mate with the connective sheaths **76** and **78** on the backpack **20** thereby creating two points of support, instead of one. Additionally, 3, 4, or 5 backpack supports could be used respectively with 3, 4, or 5 connective sheaths **76** and **78** on the backpack **20**. Alternatively, the backpack supports can include a connective sheath or pocket configured to mate with an internal frame or connective rod located on the backpack. (Not shown)

In other embodiments, the backpack support can include a quick release member **144** complementary to a second quick release member **80** on the backpack **20**. The quick release member **144** can be attached to the backpack support by any suitable means, including webbing **143** (e.g., nylon), stitching, fasteners, gluing, or welding. When webbing **143** is used, it is preferably secured by rivets. The quick release member **144** is useful in keeping the backpack **20** in close connection with the backpack support **170**, such that the connective member **136** does not dislodge from its sheath **76** and **78**. Alternatively, the internal frames **82** and **84** do not dislodge from the pockets on the preferred embodiment of the backpack support **170**. Additional quick release members (e.g., 2, 3, and 4) can be present on the backpack support **170** that are complementary to quick release members on the backpack, according to additional embodiments. (Not shown)

The connective members **136** on the backpack support **170** can attach to the backpack **20** in all the ways described above with respect to the connective rods **86** and **88**, the connective sheaths **76** and **78**, and with the latched rods **130** and spring sheaths **126**. Furthermore, 1 or more connective members **136** can be used on a seat harness **121** (e.g., 2, 3, 4, 5), depending on a variety of factors, non-exclusively including the weight of the backpack **20**, and the number of internal frames **82** and **84** and connective sheaths **126**, **76**, and **78** attached to the backpack **20**.

According to preferred embodiments, a user can attach two backpack supports **170** on the seat harness **121** before wearing the seat harness **121**. FIG. **11***b* depicts the placement of one preferred backpack support on the seat harness **121** for clarity. The placement of the backpack support **170** found in FIG. **11***a*, is preferably adjacent to said frame members **82** and **84** and/or exposed sheaths **76**, **78**, or **126**.

According to preferred methods of attaching the backpack **20** to said backpack support **170**, the user can advantageously position the padding **142** to align with the seat harness padding **120** for additional comfort. The user can preferably tighten webbing **140** that is threaded through buckle **138**. Upon donning the seat harness **121** integrated with the backpack support **170** by the appropriate method, the user can position the backpack **20** to attach to said backpack support **170**. Preferably, the user slides their appropriate arms through their respective shoulder pads **22** and **24** and shrugs their shoulders in order to slide the connective member **136** into its respective connective sheath **76**, **78**, or **126** or frame members **82** or **84** into a pocket found on backpack support **170**.

FIG. **12***a*-**12***g* depict an alternative backpack support **172** configured to attach to an off-the-shelf seat harness **121** and rapidly attach to and detach from a backpack **20**. This embodiment is similar to the backpack support **170** depicted in FIG. **11**, and described in detail above. All features of the backpack support **170** not relating to connection to the backpack **20** are applicable to these embodiments. In this embodiment, the support structure **134** can be a rigid plastic, or other suitable rigid or semi-rigid material. The support structure **134** preferably has a curved upper section to hook over the top of seat harness **121** and padding **120**. The webbing **140** can be secured to the top of the support structure **134** and is configured to secure support structure **134** around the seat harness **121** and padding **120**. Preferred webbing **140** is made of nylon webbing, or other suitable strong and pliable material. The padding **142** is preferably attached to the webbing **140** and can be made of any suitable cushioned material, including encased closed celled foam, for example. Padding **142** is not necessary to the function of this device and need not be used for all embodiments. Preferably, the backpack support **172** includes adjustable webbing **140** threaded through a buckle **138** to allow the user to tighten and loosen the support element **134** around the seat harness padding **120**.

Additional features can be added to the backpack support **172** to prevent lateral movement along the padding of the seat harness **121** by utilizing hook and loop fasteners such as VELCRO®, snaps, or other fasteners. For example, fasteners can be attached to the internal side of the support element **134** and/or padding **142** that are configured to couple with complementary fasteners on harness padding **120**.

In highly preferred embodiments, the backpack support **172** includes a mount **148** that is molded into the support structure **134** and forms an opening, preferably a half-cylinder opening, configured for receiving a mating connector **162** attached to the frame members **82** or **84** of backpack **20**. Preferred mating connectors **162** non-exclusively include frame members, **82** and **84**, for example. The inside diameter of the opening (e.g., half-cylinder opening) in the mount **148** is preferably slightly larger than the outside diameter of the mating connector **162** attached to the backpack **20**. In further embodiments, a support **146** can be molded into the base of the mount **148**. Advantageously, the support **146** helps prevent the mating connector **162** from slipping downward when a load is applied.

According to further embodiments, reinforcement members **154** can structurally reinforce the support **146** in order to withstand large loads. In further advantageous embodiments, a singular or plurality (e.g., 1, 2, 3, 4, 5) of pivoting gates **150** and a singular or plurality of top-gates (e.g., 1, 2, 3, 4, 5) **152** can be attached to hinges **156** that are secured to mount **148**. The top-gate **152**, as depicted in FIG. **12***f*, is preferably constructed with a raised-lip **166** on the interior cylindrical cut. A flat metal spring **158** and/or a torsion spring **160** centered around hinge **156** can be configured to provide force to push gates **150** and top-gate **152** in a vertical position as seen in FIG. **12***c* (closed position). While FIGS. **12***c* and **12***d* depict the use of both a flat metal spring **158** and a torsion spring **160**, it is usually preferred that one or the other is used, and not both. Preferred means for attaching the flat metal spring **158** to mount **148** nonexclusively include one or more screws (e.g., 2, 3, 4), but any suitable means can be used. Preferably, the torsion spring **160** is positioned between the gates (gates **150** and the top-gate **152**) and the mount **148** and centered around hinge **156** for each gate (gates **150** and top-gate **152**).

In further embodiments, it is preferred where one end of the torsion spring **160** pushes gates **150** or top-gate **152** to a closed position, the opposite end of the torsion spring **160** produces a resulting force against the mount **148**. In further embodiments, other means, including means utilizing other types of springs, can provide a torque on gates **150** and top-gate **152** to force them into a closed position. In preferred embodiments, closed gates **150** and top-gate **152** are configured to open when a mating connector **162** is pressed against them. (See FIG. **12***d*). Preferably, the gates **150** and top-gate **152** include a top inclined cut in this configuration. Preferably, after a mating connector **162** is pushed against mount **148**, the gates **150** and top-gate **152** are forced to a closed position by said springs (torsion spring **160** and/or flat metal spring **158**). In order to open the gates **150** and top-gate **152** the user can preferably apply manual force. Other embodiments of this spring loaded attachment device are further contemplated, including varying the number of gates **150**, the number of top-gates **152**, and the applications of spring force, or utilizing non-spring returned gates (gates **150** and top-gate **152**) that maintain a closed position with latches, for example.

In preferred embodiments, a user can put the backpack support **172** on in a similar way as with the backpack support **170** depicted in FIG. **11***b*. More preferably, the user can utilize two backpack supports **172** attached to their seat harness **121** configured to engage with two mating connectors **162** attached to the frame members **82** and **84** in the backpack. Those with skill in the art will readily appreciate that a different number of backpack supports **172**, and corresponding mating connectors **162** and frame members **82** and **84** can be used herein. In certain embodiments, only a single backpack support **172** is used; configured to engage with a single mating connector **162** attached to a single frame member on the backpack **20**, for example.

While the user can attach the backpack **20** to the backpack support **172** using any appropriate means, in preferred embodiments, the wearer can shrug their shoulders and mechanically push the mating connector **162** against the top angled cuts of gates **150** and top-gate **152** to open the gates. As discussed above, when gates **150** and top-gate **152** open, the mating connector **162** can slide past the gates. Preferably, when the mating connector **162** is pushed against the mount **148**, the gates **150** and top-gate **152** close. The wearer can repeat the action for every mating connector **162** and backpack support **172**. After each backpack support **172** (e.g., 1, 2, 3, 4) is engaged to the appropriate mating connector **162** (e.g., 1, 2, 3, 4), the wearer can then stop shrugging their shoulders.

For each backpack support **172** and mating connector **162** pair, it is preferred that the mating connector **162** slides down and rests on bottom support **146**. According to further

embodiments, the raised-lip **166** of the top-gate **152** can be configured to mate with a groove **164** on a mating connector **162** (See FIGS. **12***e* and **12***f*). Just prior to resting on support **146**, it is preferred that the groove **164** in mating connector **162** is positioned adjacently to the raised-lip **166** of the top-gate **152**. This configuration allows the top-gate **152** to close more tightly on the mating connector **162** than the other gates **150**, as the raised-lip **166** rests against the smaller diameter of groove **164**, thereby reducing the possibility of mating connecter **162** sliding out of the backpack support **172**. Other embodiments include using a raised-lip **166** on any of the other gates **150**, or reversing the configuration, such that the raised-lip is located on 1 or more mating connectors **162** and the groove **164** is located on one or more of the gates (gates **150** or top-gate **152**). For any of the above described configurations, a plurality of raised-lips and grooves can be used. Further embodiments of a backpack support **172** can include an attached buckle configured to mate with buckle **80** found on backpack **20** such that the mating connector **162** is prevented from detaching from the backpack support **172**.

According to preferred embodiments, to release backpack **20** from the backpack supports **172** provided herein, the wearer applies force to the gates **150** and top-gate **152**, thereby pivoting them open and thus freeing the mating connector **162** from the mount **148**. If desired, the user may shrug their shoulders to further detach the mating connector **162** from the mount **148**. Alternatively, these positions and embodiments are interchangeable such that the mating connector can be positioned on the backpack support and the mount can be positioned on the backpack **20**. More specifically, the hinged gates described above can be located on a mount positioned on the backpack where a complementary mating connector is position on the backpack support. All embodiments described above may be interchanged and used in this configuration.

The position of all means described herein for connecting the backpack supports to the backpacks, including means for supporting the backpacks, can readily be reversed between the backpack supports and the backpacks. For example, the backpack can include a connective member or a hinged gate assembly. Additionally, all means for connecting to and supporting the backpacks can be interchanged between the backpack supports and hip belts. For example, the backpack supports can include connective rods, latched rods, or pockets configured to engage with an appropriate connection member on the backpack. Likewise, the hip belt/backpack assemblies provided herein can include mating connectors and hinged gate connectors.

The invention may be embodied in other specific forms besides and beyond those described herein. The foregoing embodiments are therefore to be considered in all respects illustrative rather than limiting, and the scope of the invention is defined and limited only by the appended claims and their equivalents, rather than by the foregoing description.

What is claimed is:

1. A backpack assembly configured to be worn by a user and comprising:

(a) a main storage enclosure with one or more shoulder straps that when said straps are worn, the main storage enclosure abuts a user's back and a portion of the main storage enclosure's load is transferred to the user's shoulders,

(b) a separate seat harness comprised of an adjustable waist loop in operable connection with pliable material configured to form leg loops such that the separate seat harness has sufficient strength to safely disperse fall-arrest forces to the user's legs and waist when worn by itself, and

(c) a hip belt constructed from a bottom panel of pliable material having a top edge,

wherein the top edge is hinged to a bottom edge of a top panel of pliable material such that the bottom and top panels are substantially the same size and the bottom and top panels can fold together and unfold away from each other to allow for the removable insertion of the adjustable waist loop of the separate seat harness between said bottom and top panels,

wherein the user can detach and attach the main storage enclosure to the hip belt while the user is securely wearing the separate seat harness with the adjustable waist loop of the separate seat harness releasably inserted into the hip belt, and the separate seat harness has sufficient strength to safely disperse fall-arrest forces to the user's legs and waist when operably and releasably coupled to the hip belt and in conjunction with the main storage enclosure,

wherein the hip belt comprises means for transferring a substantial portion of the main storage enclosure's load to the user's hips independent of the user wearing the separate seat harness and a portion of the main storage enclosure's load to the adjustable waist loop of the separate seat harness with the adjustable waist loop of the separate seat harness removably inserted into said hip belt.

2. The backpack assembly of claim **1**, wherein said means for transferring the main storage enclosure's load consists of one or more support rods and complementary sheaths, and quick release fasteners which allow for releasable attachment between the main storage enclosure and the hip belt.

3. The backpack assembly of claim **1**, wherein said means for transferring the main storage enclosure's load comprises a rigid frame member attached to the main storage enclosure and configured to engage with a pocket located on the hip belt.

4. The backpack assembly of claim **1**, wherein said means for transferring the main storage enclosure's load comprises a plurality of rigid frame members attached to the main storage enclosure and configured to engage with a plurality of pockets located on the hip belt.

5. The backpack assembly of claim **1**, further comprising a layer of material positioned to abut against a user's back when worn, wherein said layer of material comprises an opening configured to allow a user to insert and remove a safety, load-bearing chest harness behind said layer of material and further comprises a plurality of openings configured to allow said user to access and properly secure the inserted chest harness on their body while wearing said backpack assembly wherein the properly secured chest harness has sufficient strength to suspend the combined weight of the loaded backpack assembly and the user.

6. The backpack assembly of claim **5**, wherein said layer of material is a pocket constructed from fabric and configured to receive back padding such that said pocket is sewn substantially around its perimeter to said main storage enclosure, and is configured to allow an inserted safety, load-bearing chest harness to suspend the combined weight of a loaded backpack assembly and a user without damaging the backpack assembly.

7. The backpack assembly of claim **1**, wherein the top panel of pliable material consists of padding adjacent to the user's hips and the bottom panel of pliable material is capable of transferring a significant portion of the main storage enclosure's load to the user's hips.

8. A backpack assembly comprising:

(a) a main storage enclosure with one or more shoulder straps that when said straps are worn, the main storage enclosure abuts a user's back and a portion of the main storage enclosure's load is transferred to the user's shoulders,

(b) a separate seat harness comprised of an adjustable waist loop in operable connection with pliable material configured to form leg loops such that the separate seat harness has sufficient strength to safely disperse fall-arrest forces to the user's legs and waist when worn by itself, and

(c) a separate hip belt constructed from a bottom panel of pliable material having a top edge, wherein the top edge is hinged to a bottom edge of a top panel of pliable material such that the bottom and top panels are substantially the same size and can fold together and unfold away from each other to allow for the removable insertion of the adjustable waist loop of the separate seat harness between said bottom and top panels wherein the user can detach and attach the main storage enclosure to the separate hip belt while the user is securely wearing the separate seat harness with the adjustable waist loop of the separate seat harness releasably inserted into the separate hip belt, and the separate seat harness has sufficient strength to safely disperse fall-arrest forces to the user's legs and waist when operably and releasably coupled to the separate hip belt and in conjunction with the main storage enclosure, wherein the separate hip belt comprises means for transferring a substantial portion of the main storage enclosure's load to the user's hips independent of the user wearing the separate seat harness and to the adjustable waist loop of the separate seat harness with the adjustable waist loop of the separate seat harness removably inserted into said separate hip belt.

9. The backpack assembly of claim 8, wherein at least one of said bottom and top panels includes padding.

10. The backpack assembly of claim 8, wherein said means for transferring the main storage enclosure's load comprises a rigid frame member attached to the main storage enclosure and configured to engage with a pocket located on the separate hip belt.

11. The backpack assembly of claim 8, wherein said top and bottom panels are both continuous, such that there are no significant openings in the panels.

12. The backpack assembly of claim 8 wherein the top panel of the hip belt is continuously hinged to the bottom panel of the hip belt along the length of the hinged edge.

13. The backpack assembly of claim 8, wherein said top and bottom panels include means for releasably attaching to each other when said panels are folded together.

14. The backpack assembly of claim 13, wherein at least one of said panels comprises a buckle configured to releasably attach to the other panel when said top and bottom panels are folded together.

15. The backpack assembly of claim 13, wherein said top panel includes a plurality of flaps wherein at least one flap comprises a releasable fastener configured to couple with a releasable fastener on said bottom panel when the top and bottom panels are folded together.

16. The backpack assembly of claim 15, wherein with the adjustable waist loop of the separate seat harness removably inserted into the hip belt said flaps are located on the side of the adjustable waist loop of the separate seat harness opposite the user's body, wherein at least one flap is coupled to the bottom panel.

17. A backpack assembly comprising:

(a) a main storage enclosure with one or more shoulder straps that when said straps are worn, the main storage enclosure abuts a user's back and a portion of the main storage enclosure's load is transferred to the user's shoulders,

(b) a separate seat harness comprised of an adjustable waist loop in operable connection with pliable material configured to form leg loops such that the separate seat harness has sufficient strength to safely disperse fall-arrest forces to the user's legs and waist when worn by itself, and

(c) a hip belt constructed from an inner panel and an outer panel of material having a top edge and a bottom edge, wherein the top edge of the inner panel is coupled to a top edge of an outer panel of material of substantially the same size as the inner panel such that the length of said outer and inner panels substantially traverse around the circumference of the user's hips, wherein said outer panel and inner panel of the hip belt define a space configured to allow for the removable insertion of the adjustable waist loop of the separate seat harness between said inner and outer panels, wherein the user can releasably detach and attach the main storage enclosure to the hip belt while the user is securely wearing the separate seat harness with the adjustable waist loop of the separate seat harness removably inserted into the hip belt, and the separate seat harness has sufficient strength to safely disperse fall-arrest forces to the user's legs and waist when the adjustable waist loop of the separate seat harness is releasably inserted into the hip belt and in conjunction with the main storage enclosure, and the hip belt comprises means for transferring a substantial portion of the main storage enclosure's load to the user's hips independently or with the adjustable waist loop of the separate seat harness removably inserted into said hip belt.

18. The backpack assembly of claim 17, wherein both panels are continuous, such that there are no significant openings in the panels.

19. The backpack assembly of claim 17, wherein said means for transferring the main storage enclosure's load comprises a rigid frame member attached to the main storage enclosure and configured to engage with a pocket located on the hip belt.

20. The backpack assembly of claim 17, wherein said means for transferring the main storage enclosure's load comprises a plurality of rigid frame members attached to the main storage enclosure and configured to engage with a plurality of pockets located on the hip belt.

21. The backpack assembly of claim 17, wherein the inner panel consists of pliable padding and the outer panel consist of a rigid material and said inner panel and said outer panel can fold and unfold away from each other.

22. The backpack assembly of claim 17, wherein the inner panel and the outer panel are constructed of pliable material and the bottom edge of the inner panel of pliable material is coupled to the bottom edge of the outer panel of pliable material such that the defined space is a channel configured to allow for the removable insertion of the adjustable waist loop of the separate seat harness.

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